THE

FIRST STEPS IN NUMBERS;

DESIGNED TO LEAD THE PUPIL TO A

THOROUGH PRACTICAL ACQUAINTANCE

WITH THE

ELEMENTARY OPERATIONS ON NUMBERS,

AND THE APPLICATION OF THE

DECIMAL SYSTEM.

BY

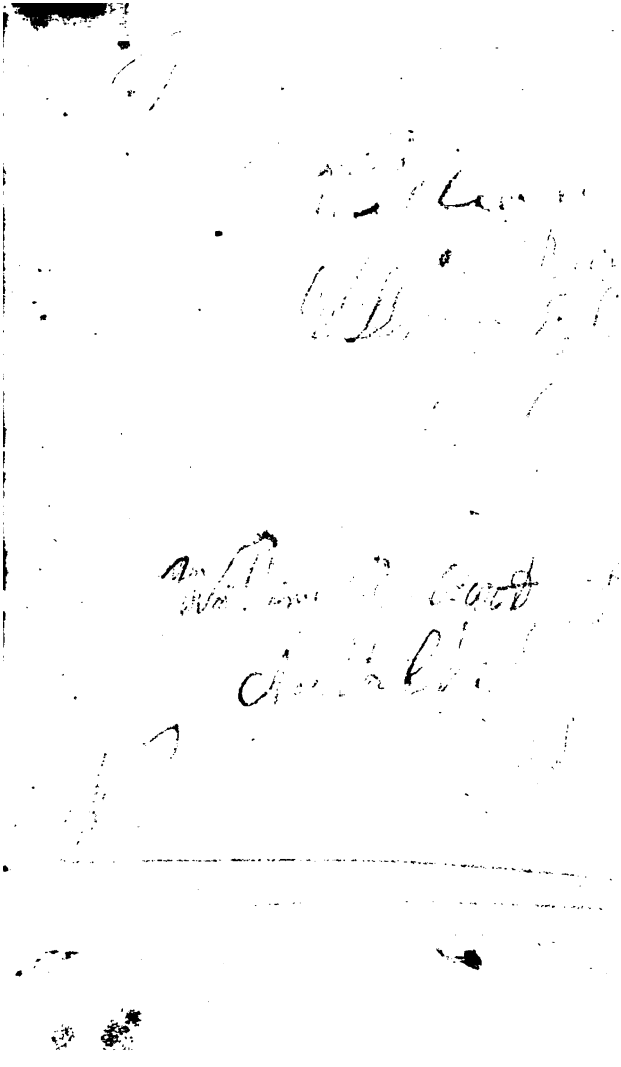
D. P. COLBURN AND G. A. WALTON,

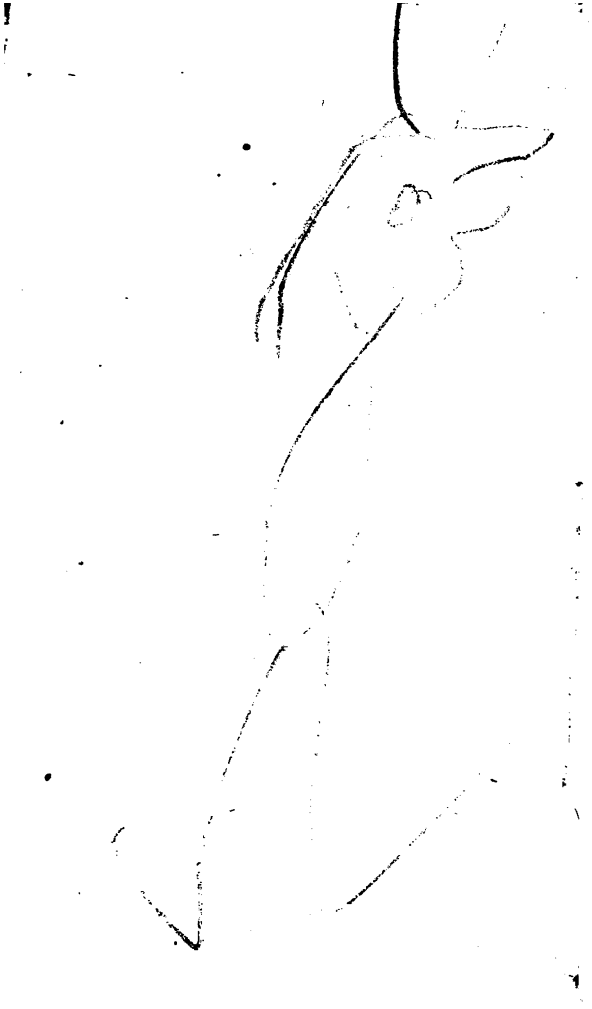
GRADUATES OF THE STATE NORMAL SCHOOL, BRIDGEWATER, MASS.

BOSTON:

BENJAMIN B. MUSSEY & CO.

1852.





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1851.

STEREOTYPED BY
GEORGE A. CURTIS;
NEW ENGLAND TYPE AND STEREOTYPE FOUNDRY.

TO

N. TILLINGHAST, ESQ.,

PRINCIPAL OF THE STATE NORMAL SCHOOL, BRIDGEWATER, MASS.,

THIS LITTLE WORK IS, WITH HIS PERMISSION,

RESPECTFULLY DEDICATED,

BY

HIS FORMER PUPILS,

THE AUTHORS.

PREFACE.

This work embodies a plan of instruction pursued by the authors in their schools; and, thinking that perhaps it may have some merit as an elementary Treatise, they present it to the public.

INTRODUCTORY OBSERVATIONS.

It may appear strange to those who have never thought upon the subject, but we believe that children usually pass over many pages of arithmetic, and often go "through the book," without ever having had any clear idea of the value and use of numbers. The irrelevant answers, or rather wild *guesses* at answers, which the teacher so often hears, can only be caused by an utter ignorance of the meaning of the words used, and the operations attempted to be performed.

The mathematics are *called* "the exact sciences," and arithmetic is made the first step towards a knowledge of them; yet the pupil is commonly taught to test the exactness of an arithmetical operation, and the truth of its result, only by reference to the "Key." The tendency of such training must not only be to render arithmetic valueless as an exercise of the mind, but, worse than this, to destroy the scholar's confidence in the results of his own reasoning, and to prevent freedom and independence of thought.

The difficulties which are the cause of all this uncertainty, may be removed in the first stages of the pupil's progress; but the teacher must remove them by his illustrations and explanations. The best and most perfect *book* can give the young pupil no idea of number, without the teacher's assistance. To the *teacher*, then, we suggest the following, as a method of teaching the elementary ideas of number.

Having a class of pupils before you, show them a single thing, as a book, and say, "Here is one book;" then, exchanging this book for another, ask, "What have I now?" If none know, tell them, "One book." Show them, in this manner, a great variety of single things, continuing the exercise till they can apply the term *one* to each. Let them denote actions in the same manner; as, "one tap," "one motion of the hand," &c.

Next write the character 1, and, after explaining that its *use is to stand* for a single thing, teach the class to write and *apply it. Assign them as a lesson, to print the names of*

many things as they can, prefixing to each the character 1. At the next exercise, the result of this work may be examined to determine its accuracy and neatness. Expecting but little, welcome the least indication of effort, and encourage to greater exertions.

The number two may be introduced thus; taking in each hand a single thing, perhaps a pencil, ask, "What have I in my right hand?" *Ans.* "One pencil." *Ques.* "In my left?" *Ans.* "One pencil." Then, putting the two together, say, "When we have one thing and one thing together, we call them two things. Here I have one pencil and one pencil; what shall we call them?" If they cannot answer, using the word *two*, tell them. Continue to give such illustrations, till the class have obtained a clear idea of the meaning of the word *two*, and can apply it to things present and absent, and to actions as well as things.

By comparing two things with one, lead them also to observe the relations existing between two numbers; as, that two is one more than one; one is one less than two; it takes two ones to make two; take one from two, and one remains, &c. This will assist in giving a good idea of the numbers, and also of the operations upon them.

Write and explain the character 2, and let the class write and apply it, as they did the character 1.

Teach the other numbers in the same manner; and compare the value of each, by means of *visible things*, with the value of those previously learned; taking care not to leave any number till applications enough have been made to enable the pupil to apply it correctly to things of any kind.

A class should not be taught to count further than ten, before commencing the exercises in our first sections.

At the head of each of the first seven sections, we have placed questions which include all the combinations (not before used) that can occur in addition and subtraction without involving higher numbers than are found in that section. We have first given abstract examples, because we believe that no pupil should attempt to study a *written* lesson in arithmetic, till he can understand the abstract numbers used in the lesson he studies, so as to apply them *himself* to things. Indeed, this will be found to be one of the most valuable and interesting exercises a class can take. Suppose, for instance, they are practising upon the combinations of numbers that *make four, and* are applying the abstract numbers to things; *perhaps one will* read the first question thus: "How many *apples are three* apples and one apple?" Another will read

the next, "How many pins are one pin and three pins?" Another, "How many birds are two birds and two birds?" And so with the other forms.

Of course, the first great objects in all operations on numbers, are accuracy and certainty; and the next object is rapidity. We think all of these will be attained, if the pupil thoroughly learns the operations on each number before he passes to the next. He should learn them so thoroughly, that the *mention* of an example will bring to his mind, as by intuition, the result. To assist in securing this thoroughness, we have given the same combination in several different forms.

In performing the operations, each number should be considered as a whole, standing for a collection of things, but capable of being increased or diminished, united with another number denoting things of the same kind, or of being separated into parts. We would especially caution against allowing the pupil to add or subtract separately each of the units of which a number is composed, whether he does it by counting his fingers, or by counting, abstractly, the successive units of the number to be added. If he is adding two and three, instead of allowing him to count two, three, four, five, teach him to put the three with the two *at once*, and *then* determine the result.

To secure the attention and interest of the class, give the questions promptly, and require the answers to be given promptly. If any one hesitates, or appears at all doubtful as to the result, give some visible illustration of the operation.

Suppose the question to be, How many are four and three? let the teacher show him four things — pieces of chalk, perhaps — in one place, and three in another; then, putting them together where the scholar can count them, ask how many there are. "Then how many pieces of chalk are four pieces of chalk and three pieces of chalk?" "How many apples are four apples and three apples?" &c. "Then how many are four and three?" "Do you think you can remember?" "Yes," says the little fellow. "What are you to remember?" *Ans.* "That four and three are seven." "Four what, and three what?" *Ans.* "That four things of any kind, and three things of the same kind, are seven things of that kind."

When the pupil has advanced as far as section eighth, he *will have* passed over all the combinations of simple numbers *that can* occur in addition and subtraction; and if these *have been* mastered, to be able to add and subtract a

number whatever, he has only to learn the decimal system, and its application. Of this, section eighth is designed to be an illustration.

We have left it to the teacher to explain the mathematical signs and terms used, because we believe that whether they are explained in a book or not, he will have to do it before the pupil will understand them.

To avoid, as much as possible, the confusion arising from introducing too many new things at once, in our first section we have not used any of the mathematical signs indicative of the operations performed; and with the same object in view, when we have introduced them, we have introduced them one by one.

The sign + may be read *and*, till its meaning is well understood; after which, the word *plus* may be substituted for it.

The sign = may, at first, be read *are* or *is*, and afterwards explained as meaning *equal*, or *equal to*.

For the sign —, at first read *less*, and afterwards, if you please, *minus*.

The exercises on the abstract numbers are so arranged that the class can be profitably employed at their seats in performing and writing the operations on their slates. The following exhibits the form for addition; the other forms will suggest themselves.

$$1 + 5 = 6 \qquad 2 + 4 = 6$$
$$5 + 1 = 6 \qquad 3 + 3 = 6$$
$$4 + 2 = 6$$

We must repeat that we consider it essential that the teacher should give enough illustrations, *with the aid of visible things*, to insure that the meaning and use of each operation is perfectly comprehended by the pupil.

THE

FIRST STEPS IN NUMBERS.

SECTION I.

A. 1. How many are 1 and 1?
2. 1 and what are 2?
3. 1 from 2 leaves what? *Ans.* 1 from 2 leaves 1.

Proof. 2 equals 1 and 1; therefore if 1 be taken from 2, 1 will remain.

4. How many more are 2 than 1? *Answer and Proof.* 2 is 1 more than 1, because 1 and 1 more make 2.
5. How many less than 2 is 1? Then 2 less 1 are how many?
6. 2 less what are 1?

B. 1. How many are 2 and 1? 1 and 2?
2. 2 and what are 3? 1 and what?
3. 1 from 3 leaves what? 2 from 3?
4. How many more are 3 than 2? than 1?
5. How many less than 3 is 1? 2? Then 3 less 2? 1?
6. 3 less what are 2? 1?

C. 1. How many are 3 and 1? 1 and 3? 2 and 2?
2. 3 and what are 4? 2 and what? 1 and what?
3. 1 from 4? 3 from 4? 2 from 4?
4. How many more are 4 than 2? than 3? than 1?

5. How many less than 4 are 2? 3? 1? The 4 less 2? 1? 3?

6. 4 less what are 3? 1? 2?

D. 1. How many are 4 and 1? 1 and 4? and 2? 2 and 3?

2. 1 and what are 5? 3 and what? 4 and what? 2 and what?

3. 3 from 5? 4 from 5? 1 from 5? 2 from 5?

4. How many more are 5 than 4? than 1? than 3? than 2?

5. How many less than 5 are 3? 1? 2? 4? Then 5 less 2? 4? 3? 1?

6. 5 less what are 4? are 3? 2? 1?

E. 1. How many are 1 and 1 and 1? *Ans.* 1 and 1 are 2, and 1 are 3. 2 and 2 and 1? 1 and 1 and 2? 1 and 1 and 3? 3 and 1 and 1? 2 and 1 and 2? 1 and 3 and 1? 2 and 1 and 1? 1 and 2 and 1? 1 and 2 and 2?

2. 2 and 1 and what are 5? *Ans.* 2 and 1 are 3, and 2 are 5. 1 and 3 and what are 5? 1 and 1 and what are 4? 3 and 1 and what are 5? 1 and 1 and what are 5?

3. 2 and 3 less 1? *Ans.* 2 and 3 are 5, less 1 are 4. 2 and 1 and 2 less 3? 1 and 3 less 2? 3 and 2 less 4? 2 and 2 less 3? 1 and 2 and 2 less 1 less 2?

F. 1. If your father give you 1 apple, and you find 1, how many will you have? How many more than before you found 1? If you eat 1, how many will you have left? How many less will you have than before you ate 1?

To the Teacher. — After the questions contained in each *example have* been solved, it will be found a valuable *exercise for the* pupil to read the entire example, substituting

for the question as it now stands, its answer: thus, after Example 1:

If your father give you 1 apple and you find 1 you will have 2, which is 1 more than before you found 1. If you eat 1 you will have 1 left, which is 1 less than before you ate 1. The answers to questions in abstract numbers, like those under E, may be read in a similar manner; thus, first question in ex. 1. 1, 2, 3. First in ex. 2. 2, 3, 2. In ex. 3. 2, 5, 4.

2. John has 2 apples and Mary has 1; how many more has John than Mary? How many less has Mary than John? How many have both? How many more have both than John? than Mary? How many more must Mary get to have as many as John? If John should give away 1 of his, how many would he have left? How many would John and Mary then have?

3. Sarah has 2 picture-books, and Jane has 3; how many have both? How many must Sarah get to have as many as Jane?

4. 5 boys were playing ball, but 2 of them soon went away; how many remained?

5. 2 birds were on the ground, and 2 on a tree; how many were in both places?

6. A poor woman received 2 cents of John, 1 of Jason, and 1 of James; how many did she receive from all? She spent 3 cents for bread; how many had she left?

7. A match-boy sold 2 bunches of matches to one man and 2 to another; how many bunches did he sell? For the first lot he got 2 cents, and for the second 3; how many cents did he get for both lots?

8. Albert's father gave him 2 apples, and his mother gave him 1; how many did both give him? He afterwards found 2; how many did he then have? How many will he have left if he eat 2?

9. *A little* girl had money enough to buy a pencil *for 2 cents*, some paper for 1 cent, and a pen for

cents; how much money had she? How much money will she have left if she buys only the pencil and pen?

10. There were 2 robins, 1 cherry-bird, and 2 linnets on a tree; how many birds were there on the tree? The robins flew away; how many birds were left on the tree?

11. A man who had 5 apples gave away all but 2 of them; how many did he give away? He soon after found 2; how many did he then have?

SECTION II.

A. 1. How many are 5 + 1? 1 + 5? 4 + 2? 2 + 4? 3 + 3?

2. 4 + what are 6? 3 + what? 1 + what? 5 + what? 2 + what?

3. 2 from 6? 4 from 6? 1 from 6? 3 from 6? 5 from 6?

4. How many more are 6 than 1? than 4? than 3? than 2? than 5?

5. How many are 6 less 3? less 5? less 2? less 4? less 1?

6. 6 less what are 4? 1? 3? 2? 0? 5?

B. 1. How many are 6 + 1? 1 + 6? 5 + 2? 2 + 5? 4 + 3? 3 + 4?

2. 6 + what are 7? 4 + what? 3 + what? 2 + what? 1 + what? 5 + what?

3. 2 from 7? 5 from 7? 1 from 7? 4 from 7? 6 from 7? 3 from 7?

4. How many more are 7 than 5? than 1? than 3? than 2? than 6? than 4?

5. How many are 7 less 3? less 6? less 2? less 5? less 1? less 4?

6. 7 less what are 6? 4? 6? 5? 3? 2?

C. 1. How many are 1 + 2 + 3? 2 + 2 + 2? 1 + 4 + 2? 3 + 2 + 2? 1 + 2 + 2 + 2? 2 + 2 + 3? 1 + 3 + 2?

2. 2 + 1 + what are 6? 4 + 2 + what are 7? 2 + 2 + what are 7? 3 + 1 + what are 6? 3 + 2 + what are 7? 2 + 2 + what are 6?

3. How many are 3 + 3 less 2? 2 + 5 less 4? 2 + 3 + 2 less 5? 2 + 2 less 3? 1 + 4 less 3? 2 + 1 + 2 less 3?

D. 1. Bought some raisins for 4 cents, and some figs for 3 cents; how many cents did both cost?

2. Francis has 2 books, and David has 4; how many more has David than Francis? If David gives his to Francis, how many will Francis then have?

3. There were 4 apples on a tree, and 3 on the ground; how many were there in both places? 1 apple fell from the tree; how many remained on? How many were there on the ground? How many in both places?

4. Alfred has 5 books with pictures in them, and 2 without; how many has he in all? How many more has he with pictures than without?

5. There were 7 passengers in an omnibus; 3 of them were gentlemen, and the rest were ladies; how many were ladies? 1 gentleman and 2 ladies got out at a hotel; how many gentlemen were left in the omnibus? How many ladies? How many passengers?

6. At school, last Tuesday, Lucy answered 2 questions in geography, 3 in grammar, and 2 in arithmetic; how many did she answer in all?

7. *Sophia* has 6 books; 3 of them were given to her by her father, 2 by her mother, and the rest by

her brother; how many were given by her brother? How many more books must she get to have 7?

8. James answered 3 questions in arithmetic, John answered 2, and Joseph answered 2; how many did they all answer? How many more did all answer than James? than Joseph? than John?

9. There were 6 boys in a class; 4 of them had good lessons, and the rest, who were idle boys, had not; how many had not? One of the idle boys missed 2 questions, and the other missed 5; how many did both miss?

10. A woman picked 2 quarts of berries on Monday, 3 quarts on Tuesday, and 2 quarts on Wednesday; how many did she pick in all? She sold 4 quarts; how many had she left?

11. In a pasture there are 2 brindled cows, 3 red cows, and 1 black cow; how many cows are there in the pasture?

12. A boy who had 7 cents, spent 3 cents for nuts, and 2 cents for candy; how many cents had he left? How many marbles, at the rate of 3 for a cent, could he buy with the money he had left?

SECTION III.

A. 1. How many are $7+1$? $1+7$? $6+2$? $2+6$? $5+3$? $3+5$? $4+4$?

2. $7+$ what $=8$? $3+$ what? $5+$ what $2+$ what? $6+$ what? $4+$ what? $1+$ what

3. 5 from 8? 3 from 8? 6 from 8? 1 from 8? 4 from 8? 7 from 8? 2 from 8?

4. How many more are 8 than 1? than 2? than 7? than 5? than 3? than 4? than 6?

5. 8 less 7? less 4? less 3? less 5? less less 6? less 1?

6. 8 less what = 7? = 5? = 3? = 6? = 2? = 4? = 1?

B. 1. How many are 8 + 1? 1 + 8? 7 + 2? 2 + 7? 6 + 3? 3 + 6? 5 + 4? 4 + 5?

2. 2 + what = 9? 6 + what? 5 + what? 4 + what? 1 + what? 3 + what? 8 + what? 7 + what?

3. 8 from 9? 6 from 9? 2 from 9? 7 from 9? 4 from 9? 1 from 9? 3 from 9? 5 from 9?

4. How many more are 9 than 1? than 6? than 2? than 5? than 8? than 7? than 3? than 4?

5. 9 less 6? less 1? less 3? less 5? less 7? less 8? less 2? less 4?

6. 9 less what = 8? = 7? = 2? = 3? = 4? = 6? = 5? = 1?

C. 1. 2 + 3 + 3? 3 + 4 + 2? 2 + 4 + 2? 5 + 2 + 2? 3 + 3 + 3? 2 + 2 + 2 + 2? 1 + 2 + 2 + 2 + 2? 1 + 3 + 3? 2 + 3 + 3?

2. 4 + 2 + what = 8? 5 + 2 + what = 9? 3 + 1 + what = 8? 4 + 1 + what = 8? 2 + 1 + what = 9? 3 + 2 + what = 9? 1 + 1 + what = 8?

3. 4 + 4 less 3? 5 + 4 less 6? 2 + 7 less 8? 3 + 4 less 5? 2 + 3 + 4 less 7? 1 + 4 + 3 less 5? 2 + 6 less 4? 4 + 3 less 2? 2 + 2 + 5 less 7?

D. 1. A man bought a pair of boots for 4 dollars, and a hat for 4 dollars; how much did he give for both? He sold each for 1 dollar less than he gave; what did he receive for each? for both?

2. A lady bought 4 yards of pink ribbon, and 5 yards of blue ribbon; how many yards did she

buy? She paid 3 dollars for the ribbon, and then had 6 dollars left; how many dollars had she at first?

3. There were 8 birds in a flock, but a gunner shot all but two of them; how many did he shoot? He had before shot 2 birds; how many did he shoot in all?

4. 6 oranges were in a basket, and 2 in a bowl; a girl took 3 oranges from the basket, and put them in the bowl; how many were there then in the bowl? in the basket? in both?

5. James had 9 cents; he spent two of them for candy, and gave three to a beggar; how many had he left? How many more must he get to have enough to pay for a book worth 8 cents?

6. There were 3 boys skating on one pond, 4 on another, and 2 on another; how many were there on all the ponds? 6 of the boys went to school to Mr. Reed, and the rest to Mr. Hyde; how many went to Mr. Hyde?

7. A man picked 4 bushels of apples from one tree, 2 from another, and 2 from another; how many bushels did he pick from all the trees? If he should sell 4 bushels of them, how many would he have left?

8. Mr. Smith owned 9 cows, but he sold 2 of them to Mr. French; how many had he left? How many more had he left than he sold? If Mr. French had 7 cows at first, how many has he now? How many more than Mr. Smith has left?

9. A gunner, on counting his game, found that he had shot 3 crows, 2 pigeons, and 2 black-birds; how many birds had he shot? He sold the pigeons to a neighbor; how many birds had he left?

10. If you had 9 pears, and should eat 4 of them, *how many would* you have left? How many less

han your brother, who has 8? If your brother should give you 3 of his, how many would you then have? How many would he have left?

11. A man bought 3 bushels of Carolina potatoes, 2 bushels of Chenango, and 4 bushels of Rohan potatoes; how many bushels of potatoes did he buy in all? He sold 2 bushels of the Rohans, and 1 bushel of the Chenangoes; how many bushels of potatoes did he sell? How many did he have left?

SECTION IV.

A. 1. How many are 9 + 1? 1 + 9? 8 + 2? 2 + 8? 7 + 3? 3 + 7? 6 + 4? 4 + 6. 5 + 5?

2. 6 + what = 10? 3 + what? 8 + what? 2 + what? 5 + what? 1 + what? 7 + what? 4 + what? 9 + what?

3. 4 from 10? 5 from 10? 1 from 10? 8 from 10? 7 from 10? 3 from 10? 9 from 10? 2 from 10? 6 from 10?

4. How many more are 10 than 7? than 4? than 6? than 8? than 3? than 9? than 2? than 1? than 5?

5. 10 less 5? less 7? less 8? less 9? less 2? less 1? less 6? less 3? less 4?

6. 10 less what = 7? = 5? = 9? = 8? = 4? = 1? = 6? = 3? = 2?

B. How many are 10 + 1? 1 + 10? 9 + 2? 2 + 9? 8 + 3? 3 + 8? 7 + 4? 4 + 7? 6 + 5? 5 + 6?

2. 7 + what equals 11? 4 + what? 8 +

what? 6 + what? 5 + what? 2 + what? 1 + what? 3 + what? 10 + what? 8 + what?

3. 6 from 11? 8 from 11? 10 from 11? 1 from 11? 7 from 11? 3 from 11? 5 from 11? 4 from 11? 2 from 11? 9 from 11?

4. How many more are 11 than 9? than 10? than 3? than 7? than 2? than 1? than 6? than 5? than 8? than 4?

5. 11 less 8? less 5? less 7? less 10? less 9? less 1? less 2? less 6? less 3? less 4?

6. 11 less what = 5? = 7? = 9? = 1? = 4? = 3? = 10? = 2? = 6? = 8?

C, 1. 4 + 4 + 3? 2 + 6 + 2? 4 + 4 + 2? 5 + 4 + 2? 3 + 4 + 3? 2 + 3 + 5? 2 + 3 + 3 + 3? 5 + 1 + 5? 1 + 3 + 3 + 3? 3 + 3 + 3? 2 + 2 + 2 + 2 + 2? 2 + 3 + 3 + 2? 1 + 2 + 2 + 2 + 2 + 2?

2. 3 + 2 + what = 10? 4 + 3 + what = 10? 2 + 4 + what = 11? 2 + 5 + what = 11? 3 + 7 + what = 11? 2 + 3 + what = 11? 4 + 4 + what = 10? 2 + 2 + what = 11?

3. 4 + 6 − 3? 5 + 6 − 8? 3 + 8 − 4? 2 + 4 + 5 − 3 − 5? 2 + 9 − 4 − 6? 4 + 6 − 8 + 3? 4 + 4 + 2 − 3 − 3 − 3? 2 + 7 + 2 − 6 − 3? 3 + 3 + 4 − 2 − 5?

D. 1. A man rode 4 miles in a car, 3 miles in a stage coach, and 4 miles in a wagon; how many miles did he ride in all?

2. Otis has 7 apples, and Russel has 3; how many have both? If Otis give 2 of his to Russel, how many will he have left? How many will Russel have? How many will both together have?

3. William and Joseph went a nutting; under *one tree, William* found 6 nuts, and Joseph 5; how *many did both* find? They ate 5 nuts and lost 2

how many had they left? On their way home they found 6 nuts; how many had they to carry home?

4. There are 4 sheep in a pasture, 5 in a yard, and 2 in the road; how many are there in all? How many more in all than in the pasture? than in the road? than in the yard?

5. A man bought 4 pounds of white sugar, and 7 pounds of brown; how many pounds of sugar did he buy? He lost 3 pounds of brown sugar on the way home; how many pounds of sugar had he left? How many pounds would he have had left if he had lost 3 pounds of white sugar instead of brown?

6. Mr. Talbot set out from Dedham to go to Boston, the distance being 10 miles; he walked 4 miles, and rode the rest of the way; how many miles did he ride in going? On his return, he walked 5 miles, and rode the rest of the way; how many miles did he ride in returning? In going and returning, how many miles did he walk? How many did he ride?

7. A trader sold 11 dollars' worth of goods to three men; to one of them he sold 2 dollars' worth, and to another 4; how many dollars' worth did he sell to the third?

8. Lucy has 6 roses, and Julia has 5; how many have both? If Lucy should give 3 of hers to Julia, how many would each have? How many both?

9. There are 10 vessels moored at a wharf; 3 of them are ships, 2 of them are barques, and the rest are schooners; how many are schooners? Each ship has 3 masts; how many masts have all the ships? Each barque has 3 masts; how many masts have all the barques? How many masts have all the schooners, if each has 2? There are 3 sailors at work on one of the ships, 3 on another, and 4

on another; how many are there on all? On one barque there are 5 sailors, and on the other 4; how many on both? There are 2 sailors on one schooner, 2 on another, 3 on another, 1 on another, and 3 on the other; how many are there on all the schooners?

SECTION V.

A. 1. 10 + 2? 2 + 10? 9 + 3? 3 + 9? 8 + 4? 4 + 8? 7 + 5? 5 + 7? 6 + 6?

2. 10 + what = 12? 8 + what? 5 + what? 7 + what? 2 + what? 4 + what? 9 + what? 6 + what? 3 + what?

3. 6 from 12? 4 from 12? 5 from 12? 3 from 12? 9 from 12? 10 from 12? 2 from 12? 7 from 12? 8 from 12?

4. How many more are 12 than 7? than 4? than 8? than 6? than 2? than 5? than 3? than 10? than 9?

5. 12 — 9? — 3? — 4? — 7? — 2? — 8? — 6? — 10? — 5?

6. 12 — what = 10? = 2? = 8? = 4? = 5? = 7? = 9? = 3? = 6?

B. 1. 10 + 3? 3 + 10? 9 + 4? 4 + 9? 8 + 5? 5 + 8? 7 + 6? 6 + 7?

2. 6 + what = 13? 4 + what? 8 + what? 3 + what? 10 + what? 9 + what? 7 + what? 5 + what?

3. 10 from 13? 6 from 13? 4 from 13? 7 from 13? 9 from 13? 8 from 13? 5 from 13? 3 from 13?

4. How many more are 13 than 3? than 10?

than 5? than 4? than 6? than 8? than 7? than 9?

5. 13 — 5? — 8? — 3? — 10? — 7? — 4? — 6? — 9?

6. 13 — what = 3? = 4? = 8? = 7? = 10? = 5? = 9? = 6?

C. 1. 4 + 6 + 2? 3 + 5 + 5? 2 + 7 + 3? 3 + 4 + 5? 8 + 2 + 3? 3 + 3 + 3 + 3? 6 + 2 + 2 + 2? 4 + 4 + 4? 1 + 4 + 4 + 4? 2 + 5 + 5? 2 + 2 + 2 + 2 + 2 + 2?

2. 5 + 4 + what = 12? 6 + 2 + what = 13? 4 + 4 + what = 12? 1 + 4 + what = 12? 3 + 3 + 3 + what = 12? 2 + 4 + 4 + what = 12? 2 + 2 + what = 13? 1 + 4 + what = 13? 3 + 2 + what = 13?

3. 4 + 3 + 5 — 8? 6 + 6 — 3? 4 + 3 + 6 — 9? 5 + 2 + 3 + 3 — 7? 8 + 4 — 3 — 6? 7 + 2 — 4 + 8? 6 + 7 — 3 — 8? 4 + 5 + 3 — 8 — 2? 1 + 4 + 2 + 2 + 4 — 7 + 6 — 8? 3 + 7 + 3 — 5 — 3 + 7? 12 — 5 — 4 + 3 + 3 + 3 — 7? 8 + 5 — 4 — 7 + 10 — 3?

D. 1. A man paid 5 cents for a loaf of bread, and 8 cents for crackers; how much did he pay for both? After he had eaten 4 of the crackers, he found he had 8 left; how many had he at first?

2. William had 7 cents, and Henry had 13; how many more had Henry than William? Henry paid 10 cents for a book, and gave all the rest of his money to William; how many cents did he give to William? How many had William then?

3. Mr. Jones owes 6 dollars to one man, 4 to another, and 3 to another; how many does he owe to all? If he pay 9 dollars of it, how much will he *still* owe?

4. If a writing-book costs 5 cents, a pen and holder 3 cents, and an inkstand 4 cents, how much will they all cost? William has 9 cents; how many more cents must he get to have enough to pay for all these articles?

5. Bought a pound of sugar for 9 cents, and a half pound of raisins for 4 cents; how much did both cost? To pay for them, I gave a dime, or ten-cent piece, and paid the rest in cents; how many *cents* did I pay?

6. David worked 6 hours on Monday, 4 on Tuesday, and 3 on Wednesday; how many hours did he work in all? How many more than Edwin, who worked 2 hours each day?

7. A provision dealer bought 6 bushels of potatoes of one man, and 4 of another; how many did he buy of both? He sold 7 bushels of them; how many had he left? The next day he bought 8 bushels; how many did he then have? He sold 4 bushels to one man, and 5 to another; how many did he have left?

8. Henry found 2 apples under one tree, 3 under another, 3 under another, and 4 under another; how many did he find under all the trees? He gave 6 of them to his brother; how many had he left?

9. There were 7 birds on one limb of a tree, and 6 on another; how many were on both? A gunner shot 5 of them, and the rest flew away; how many flew away? The gunner killed 6 other birds the same day; how many did he kill in all?

10. Mr. Gay owns a pasture, a garden, an orchard, and a wood-lot. In his pasture there are 4 acres, in his garden 3, in his orchard 2, and in his wood-lot 4; how many acres in all? If he should *sell his orchard* and wood-lot, how many acres would *he have left*?

SECTION VI.

A. 1. 10 + 4? 4 + 10? 9 + 5? 5 + 9? 8 + 6? 6 + 8? 7 + 7?

2. 4 + what = 14? 7 + what? 9 + what? 5 + what? 6 + what? 10 + what? 8 + what?

3. 6 from 14? 7 from 14? 9 from 14? 10 from 14? 4 from 14? 5 from 14? 8 from 14?

4. How many more are 14 than 8? than 6? than 10? than 9? than 7? than 5? than 4?

5. 14 — 8? — 5? — 9? — 10? — 7? — 4? — 6?

6. 14 — what = 4? = 10? = 9? = 8? = 6? = 5? = 7?

B. 1. 10 + 5? 5 + 10? 9 + 6? 6 + 9? 8 + 7? 7 + 8?

2. 6 + what = 15? 9 + what? 7 + what? 10 + what? 8 + what? 5 + what?

3. 9 from 15? 8 from 15? 5 from 15? 10 from 15? 7 from 15? 6 from 15?

4. How many more are 15 than 9? than 6? than 5? than 8? than 7? than 10?

5. 15 — 7? — 10? — 9? — 6? — 8? — 5?

6. 15 — what = 5? = 7? = 6? = 10? = 9? = 8?

C. 1. 10 + 6? 6 + 10? 9 + 7? 7 + 9? 8 + 8?

2. 9 + what = 16? 8 + what? 10 + what? 7 + what? 6 + what?

3. 7 from 16? 10 from 16? 9 from 16? 8 from 16? 6 from 16?

4. How many more are 16 than 8? than 10? than 7? than 9? than 6?

5. 16 — 6? — 8? — 7? — 9? — 10?

6. 16 — what = 8? = 10? = 9? = 6? = 7?

D. 1. 3 + 7 + 4? 6 + 3 + 6? 4 + 3 + 8? 6 + 4 + 6? 2 + 4 + 4 + 5? 7 + 2 + 7? 3 + 2 + 9? 6 + 2 + 7? 5 + 3 + 6? 4 + 3 + 7? 3 + 4 + 8? 4 + 5 + 6? 3 + 3 + 2 + 8?

2. 4 + 6 + what = 15? 2 + 6 + what = 16? 3 + 2 + 3 + what = 16? 5 + 4 + what = 16? 3 + 4 + what = 14? 2 + 4 + what = 14? 3 + 3 + what = 15? 7 + 3 + what = 16?

3. 3 + 3 + 9 — 8 — 3? 9 + 7 — 6 — 3 + 8? 7 + 3 + 4 — 6 + 8 — 9? 8 + 6 — 4 — 4 + 8? 6 + 10 — 9 + 8? 4 + 8 — 7 + 9 — 6? 3 + 4 + 9 — 10 — 3 + 8? 5 + 5 + 5 — 6 + 5?

E. 1. If 2 pounds of flour cost 9 cents, and a pound of rice 6 cents, what do both cost? How much more do both cost than a pound of raisins costing 8 cents?

2. Edwin had 16 marbles, but he gave away 6, and lost 4 of them; how many had he left? His father gave him 8 more; how many did he then have? He lost 6, and gave away 3; how many had he left?

3. If a dime be worth 10 cents, and a half dime be worth 5 cents, how many cents are both worth? Walter has 8 cents; how many more must he get to be worth as much as Joseph, who has a dime and a half dime?

4. Sarah has 9 books, and Lydia 6; how man

have both? If Sarah gives 2 of her books to Lydia, how many will each have? How many will both have?

5. A gardener picked 5 roses from one bush, 4 from another, and 7 from another; how many did he pick from all? He gave 6 of them to a little girl, 2 to a boy, and the rest to a lady; how many did he give the lady?

6. A man picked 9 bushels of apples in the forenoon, and 7 in the afternoon; how many bushels of apples did he pick in all? 4 bushels of the apples were pippins, 5 were Baldwins, and the rest were greenings; how many were greenings? He sold 3 bushels of pippins, 2 of Baldwins, and 4 of greenings; how many bushels of apples did he sell? How many had he left?

7. John picked 3 quarts of blackberries in one pasture, 4 in another, and 5 in another? How many quarts of blackberries did he pick? He spilt 2 quarts, gave away 6, and sold 2; how many had he left? He received 9 cents for one quart, and 7 for the other; how many cents did he receive for the two? He paid 10 cents for a new basket; how many cents had he left?

8. Samuel bought a quart of molasses for 10 cents, and then had 6 cents left; how many cents had he at first? He made his molasses into candy, 9 sticks of which he sold for 8 cents, and the remaining 7 sticks he gave away; how many sticks of candy did he make? How many cents had he after selling the candy?

9. There are 8 books on one shelf, and 8 on another; how many are there on both? 7 of them have gilt edges, and the rest have not; how many *have not gilt* edges? 6 of the books have pictures *in them; how* many are left without pictures?

SECTION VII.

A. 1. 10 + 7? 7 + 10? 9 + 8? 8 + 9?
2. 10 + what = 17? 8 + what? 7 + what? 9 + what?
3. 7 from 17? 10 from 17? 9 from 17? 8 from 17?
4. How many more are 17 than 9? than 10? than 7? than 8?
5. 17 — 9? — 8? — 7? — 10?
6. 17 — what = 9? = 7? = 10? = 8?

B. 1. 10 + 8? 8 + 10? 9 + 9?
2. 8 + what = 18? 10 + what? 9 + what?
3. 8 from 18? 9 from 18? 10 from 18?
4. How many more are 18 than 8? than 10? than 9?
5. 18 — 8? — 9? — 10?
6. 18 — what = 10? = 8? = 9?

C. 1 10 + 9? 9 + 10?
2. 10 + what = 19? 9 + what?
3. 9 from 19? 10 from 19?
4. How many more are 19 than 10? than 9?
5. 19 — 10? — 9?
6. 19 — what = 10? = 9?

D. 1. 10 + 10?

E. 1. 4 + 6 + 8? 3 + 6 + 9? 3 + 4 + 10? 6 + 4 + 10? 4 + 5 + 10? 3 + 5 + 10? 3 + 4 + 3 + 7? 4 + 4 + 9? 2 + 4 + 4 + 10? 3 + 5 + 9? 2 + 3 + 4 + 9?
2. 7 + 2 + what = 19? 3 + 5 + what = = 17? 6 + 2 + what = 18? 4 + 6 + what = 20? 2 + 5 + what = 17? 2 + 8 + what

= 19? 2 + 7 + what = 17? 6 + 4 + what = 18?

3. 6 + 4 + 7 − 8? 8 + 8 − 6 + 10? 7 + 10 − 8 + 10? 3 + 5 + 10 − 9 + 10 − 9? 6 + 3 + 9 − 8 − 4 + 7? 19 − 10 − 4 + 3 + 7? 20 − 10 + 6 − 8 − 3? 14 − 7 + 10 − 9 − 3?

F. 1. Fanny had a party one afternoon; 6 little girls came first, next came 3, and then 7; how many came in all? All but 8 of the girls were younger than Fanny; how many were there younger than Fanny?

2. 6 persons got into an empty car at Brighton, 4 more got into the same car at Newton Corner, and 10 at West Newton; how many got in, in all? At Needham, 10 got out; how many remained in? At Natick, 7 got in; how many were then in the car?

3. A *poor* man spent 9 cents for cigars, and 10 cents for wine; how many cents did he spend for both? The same day, he spent 10 cents for bread for his family; how much more did he spend for cigars and wine than for bread?

4. A drover bought 10 sheep of one man, and 7 of another; how many did he buy of both? He sold 8 of them to a farmer, and 2 to a butcher; how many had he left? He afterwards bought 2 of one man and 9 of another; how many had he then? How many will he have left if he sell 10?

5. Maria found 8 cherries under one tree, and 9 under another; how many did she find under both? How many more than Augusta, who found 4 under one tree, and 6 under another?

6. There are 9 boys in one class, and 10 in another; how many are there in both classes? One *class answered* 10 questions, and the other 9; how *many did both* answer? There were 6 questions

missed by one class, and 4 by the other; how many were missed by both? How many more were answered by both than missed?

7. A teacher bought 9 books of one man, and 10 of another; how many did he buy of both? He sold 9 of the books to his scholars; how many had he left? How many more must he get to have 17?

8. Jane gave 6 cents to a beggar woman, Lucy gave 4, and Sarah 10; how many did all give her? With the money, she bought some bread for 10 cents; how many cents had she left? Julia gave her 6 cents, and then she spent 8 cents more; how many cents had she left?

9. 19 boys were in a school-house yard; 10 of them were on the north side of the yard, and the rest were on the south; how many were on the south side of the yard? 6 of the boys on the north side, and 2 on the south, went into the school-house; how many were left on each side? on both sides?

SECTION VIII.

A. 1. 14 = 4 + what? 16 = 6 + what? 18 = 8 + what? 17 = 7 + what? 19 = 9 + what? 15 = 5 + what? 13 = 3 + what? 12 = 2 + what? 11 = 1 + what?

2. 14 = 10 + what? 16 = 10 + what? 19 = 10 + what? 17 = 10 + what? 13 = 10 + what? 11 = 10 + what? 15 = 10 + what? 12 = 10 + what? 18 = 10 + what?

B. 1. 4 + 4 + 10? 10 + 4 + 4?
6 + 3 + 10? 10 + 6 + 3? 3 + 2 + 10?
10 + 3 + 2? 3 + 6 + 10? 10 + 3 + 6?
2 + 7 + 10? 10 + 2 + 7? 5 + 5 + 10?

10 + 5 + 5? 3 + 1 + 10? 10 + 3 + 1?
2 + 2 + 10? 10 + 2 + 2? 1 + 5 + 10?
10 + 1 + 5? 3 + 7 + 10? 10 + 3 + 7?
2 + 8 + 10? 10 + 2 + 8? 2 + 6 + 10?
10 + 2 + 6? 1 + 7 + 10? 10 + 1 + 7?
4 + 6 + 10? 10 + 4 + 6? 1 + 3 + 10?
10 + 1 + 3? 2 + 5 + 10? 10 + 2 + 5?
1 + 9 + 10? 10 + 1 + 9?

2. 4 + 2 + 3 + 10? 10 + 4 + 2 + 3?
3 + 3 + 3 + 10? 10 + 3 + 3 + 3?
4 + 2 + 4 + 10? 10 + 4 + 2 + 4?
1 + 4 + 3 + 10? 10 + 1 + 4 + 3?
3 + 4 + 3 + 10? 10 + 3 + 4 + 3?
1 + 5 + 2 + 2 + 10? 10 + 1 + 5 + 2 + 2?
2 + 2 + 3 + 2 + 10? 10 + 2 + 2 + 3 + 2?
1 + 2 + 2 + 10? 10 + 1 + 2 + 2?
3 + 2 + 5 + 10? 10 + 3 + 2 + 5?

C. 1. 4 + 5? 14 + 5? 4 + 15?
2. 6 + 3? 16 + 3? 6 + 13?
3. 3 + 4? 13 + 4? 3 + 14?
4. 4 + 6? 14 + 6? 4 + 16?
5. 3 + 7? 13 + 7? 3 + 17?
6. 6 + 2? 16 + 2? 6 + 12?
7. 2 + 2? 12 + 2? 2 + 12?
8. 3 + 5? 13 + 5? 3 + 15?
9. 4 + 4? 14 + 4? 4 + 14?
10. 1 + 5? 11 + 5? 1 + 15?
11. 1 + 8? 11 + 8? 1 + 18?
12. 2 + 3? 12 + 3? 2 + 13?
13. 2 + 8? 12 + 8? 2 + 18?

D. 1. 4 + 2 + 3? 14 + 2 + 3? 4 + 12 + 3? 4 + 2 + 13?

2. $3+2+3$? $13+2+3$? $3+12+3$? $3+2+13$?

3. $1+3+2$? $11+3+2$? $1+13+2$? $1+3+12$?

4. $3+2+5$? $13+2+5$? $3+12+5$? $3+2+15$?

5. $5+1+4$? $15+1+4$? $5+11+4$? $5+1+14$?

6. $2+6+1$? $12+6+1$? $2+16+1$? $2+6+11$?

7. $1+2+3$? $11+2+3$? $1+12+3$? $1+2+13$?

8. $2+1+4$? $12+1+4$? $2+11+4$? $2+1+14$?

9. $5+1+2$? $15+1+2$? $5+11+2$? $5+1+12$?

10. $2+1+4+2$? $12+1+4+2$? $2+11+4+2$? $2+1+14+2$? $2+1+4+12$?

11. $2+2+3+1+2$? $12+2+3+1+2$? $2+12+3+1+2$? $2+2+13+1+2$? $2+2+3+11+2$? $2+2+3+1+12$?

E. 1. $2+\text{what}=6$? $12+\text{what}=16$? $2+\text{what}=16$?

2. $4+\text{what}=7$? $4+\text{what}=17$? $14+\text{what}=17$?

3. $3+\text{what}=4$? $13+\text{what}=14$? $3+\text{what}=14$?

4. $1+\text{what}=2$? $11+\text{what}=12$? $1+\text{what}=12$?

5. $3+\text{what}=10$? $13+\text{what}=20$? $3+\text{what}=20$?

6. $5+\text{what}=8$? $15+\text{what}=18$? $5+\text{what}=18$?

7. $4+\text{what}=10$? $4+\text{what}=20$? $14+\text{what}=20$?

8. 6 + what = 9? 16 + what = 19? 6 + what = 19?
9. 8 + what = 10? 18 + what = 20? 8 + what = 20?
10. 7 + what = 9? 7 + what = 19? 17 + what = 19?

F. 1. 3 + 2 + what = 9? 13 + 2 + what = 19? 3 + 2 + what = 19? 3 + 12 + what = 19?
2. 3 + 4 + what = 8? 13 + 4 + what = 18? 3 + 14 + what = 18? 3 + 4 + what = 18?
3. 2 + 3 + what = 10? 2 + 3 + what = 20? 12 + 3 + what = 20? 2 + 13 + what = 20?
4. 1 + 5 + what = 8? 1 + 5 + what = 18? 11 + 5 + what = 18? 1 + 15 + what = 18?
5. 1 + 6 + what = 10? 11 + 6 + what = 20? 1 + 6 + what = 20? 1 + 16 + what = 20?
6. 3 + 5 + what = 10? 3 + 5 + what = 20? 13 + 5 + what = 20? 3 + 15 + what = 20?
7. 2 + 4 + 3 + what = 10? 2 + 4 + 3 + what = 20? 2 + 14 + 3 + what = 20?
8. 2 + 1 + 2 + what = 8? 2 + 11 + 2 + what = 18? 2 + 1 + 2 + what = 18?

G. 1. 4 from 8? 4 from 18? 14 from 18?
2. 3 from 9? 3 from 19? 13 from 19?
3. 1 from 10? 1 from 20? 11 from 20?
4. 7 from 9? 17 from 19? 7 from 19?
5. 2 from 9? 2 from 19? 12 from 19?
6. 9 from 10? 19 from 20? 9 from 20?
7. 5 from 7? 15 from 17? 5 from 17?

8. 8 from 10? 8 from 20? 18 from 20?
9. 1 from 3? 11 from 13? 1 from 13?
10. 2 from 6? 12 from 16? 2 from 16?
11. 6 from 10? 6 from 20? 16 from 20?
12. 4 from 10? 14 from 20? 4 from 20?
13. 3 from 10? 3 from 20? 13 from 20?

H. 1. 4 from what = 5? 14 from what = 5? 4 from what = 15?
2. 2 from what = 1? 12 from what = 1? 2 from what = 11?
3. 5 from what = 5? 5 from what = 15? 15 from what = 5?
4. 3 from what = 6? 13 from what = 6? 3 from what = 16?
5. 8 from what = 2? 18 from what = 2? 8 from what = 12?
6. 7 from what = 3? 7 from what = 13? 17 from what = 3?
7. 3 from what = 7? 13 from what = 7? 3 from what = 17?
8. 4 from what = 1? 4 from what = 11? 14 from what = 1?
9. 5 from what = 3? 5 from what = 13? 15 from what = 3?
10. 3 from what = 5? 3 from what = 15? 13 from what = 5?
11. 6 from what = 3? 16 from what = 3? 6 from what = 13?
12. 3 from what = 4? 3 from what = 14? 13 from what = 4?

I. 1. 5 — what = 2? 15 — what = 2? 15 — what = 12?
2. *10 — what = 9?* 20 = what = 9? 20 *— what = 19?*

3. 6 — what = 2? 16 — what = 2? 16 — what = 12?
4. 8 — what = 6? 18 — what = 16? 18 — what = 6?
5. 9 — what = 7? 19 — what = 17? 19 — what = 7?
6. 10 — what = 3? 20 — what = 13? 20 — what = 3?
7. 10 — what = 5? 20 — what = 15? 20 — what = 5?
8. 7 — what = 4? 17 — what = 14? 17 — what = 4?
9. 4 — what = 2? 14 — what = 2? 14 — what = 12?
10. 3 — what = 1? 13 — what = 11? 13 — what = 1?
11. 6 — what = 4? 16 — what = 14? 16 — what = 4?
12. 8 — what = 5? 18 — what = 5? 18 — what = 15?
13. 5 — what = 1? 15 — what = 11? 15 — what = 1?
14. 10 — what = 7? 20 — what = 7? 20 — what = 17?
15. 9 — what = 5? 19 — what = 15? 19 — what = 5?
16. 2 — what = 1? 12 — what = 11? 12 — what = 1?
17. 7 — what = 3? 17 — what = 13? 17 — what = 3?
18. 4 — what = 3? 14 — what = 3? 14 — what = 13?
19. 10 — what = 4? 20 — what = 4? 20 — what = 14?
20. 9 — what = 3? 19 — what = 13? 19 — what = 3?

J. 1. 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2? 1 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2?

2. 3 + 3 + 3 + 3 + 3 + 3? 1 + 3 + 3 + 3 + 3 + 3? 2 + 3 + 3 + 3 + 3 + 3 + 3?

3. 4 + 4 + 4 + 4 + 4? 1 + 4 + 4 + 4 + 4? 2 + 4 + 4 + 4 + 4? 3 + 4 + 4 + 4 + 4?

4. 5 + 5 + 5 + 5? 1 + 5 + 5 + 5? 2 + 5 + 5 + 5? 3 + 5 + 5 + 5? 4 + 5 + 5 5?

5. 6 + 6 + 6? 1 + 6 + 6 + 6? 2 + 6 + 6 + 6?

6. 20 — 2 — 2 — 2 — 2 — 2 — 2 — 2 — 2 — 2? 19 — 2 — 2 — 2 — 2 — 2 — 2 — 2 — 2?

7. 18 — 3 — 3 — 3 — 3 — 3 — 3? 19 — 3 — 3 — 3 — 3 — 3 — 3? 20 — 3 — 3 — 3 — 3 — 3?

8. 20 — 4 — 4 — 4 — 4 — 4? 19 — 4 — 4 — 4 — 4? 17 — 4 — 4 — 4 — 4? 18 — 4 — 4 — 4 — 4?

9. 20 — 5 — 5 — 5 — 5? 19 — 5 — 5 — 5? 18 — 5 — 5 — 5? 17 — 5 — 5 — 5? 16 — 5 — 5 — 5?

10. 18 — 6 — 6 — 6? 20 — 6 — 6 — 6? 19 — 6 — 6 — 6?

11. 6 + 9 + 3 — 5 — 7 + 8? 3 + 7 + 5 + 4 — 7 + 3? 5 + 8 + 7 — 16 + 3? 3 + 15 + 2 — 7 + 4? 19 — 17 + 6 + 4 + 6 — 11? 7 + 8 — 3 — 9 — 3? 7 + 12 — 8 — 5 + 11?

12. 13 + 7 — 14 — 6 + 3? 18 — 3 + 1 — 7 — 6? 2 + 7 + 4 + 3 + 3 — 4? 8 + 3 + 4 + 3 — 3 — 2 — 3 — 2 — 3 — 2 + 13 + 3? 14 + 3 + 2 — 16 + 15 + 1 — 12?

13. 12 + 7 — 16 + 3 + 11 — 13 + 15? 13 + 2 — 8 + 7 — 11 — 3 + 7 + 6 + 6 — 19? 14 — 6 + 12 — 17 — 3 + 5 + 15? 18 — 5 + 3 — 7 — 4 + 13 — 4 — 11 + 6? 13 + 4 + 2 — 16 — 2 + 17 — 4 + 6? 3 + 3 + 13 + 1 — 4 — 5 + 8 — 13?

14. 20 — 4 — 7 — 3 + 8 + 5 — 3 — 13 + 17? 8 + 9 — 4 — 4 + 9 — 10 + 11 — 12 — 3? 17 — 8 — 5 + 9 — 3 + 9 — 18 + 13 + 6? 2 + 4 + 5 + 6 — 7 — 8 + 9 — 10 + 11 — 12?

15. 19 + 1 — 2 — 18 + 17 + 3 — 4 — 16 + 15 + 5? 19 + 1 — 18 + 2 + 16 — 17 + 3 + 14 — 15 + 5 + 10 — 13? 20 — 1 — 2 — 3 — 4 — 5 + 6 + 7 — 8 — 9 + 10? 5 + 6 + 7 — 8 + 9 — 10 + 11 — 12 + 9 — 13 + 11?

SECTION IX.

1. Lydia has answered 5 questions in grammar, 8 in geography, and 4 in arithmetic; how many has she answered in all these studies? How many more has she answered in all than in each study?

2. A drover had 17 sheep, but he sold 13 of them; how many has he left? How many more did he sell than he has left? How many must he now buy to have 20?

3. There are 16 fowls in a yard; 3 of them are ducks, 2 are geese, and the rest are hens; how many are hens?

4. There were 6 persons in an omnibus; 12 others afterwards got in, and 4 got out; how many *were then in the* omnibus? How many more *were in at first?*

5. Sarah has 3 picture books, Jane has 2, Abby has 3, and Mary has as many as all the rest; how many has Mary? How many have all? How many more must each get to have as many as all? If Mary gives 3 of her books to Sarah, how many will Sarah then have? How many will Mary have left? If Mary should give what she now has left to Jane, how many would Jane have? If Abby should give hers to Sarah, how many would Sarah have? How many would Sarah and Jane together have?

6. There were 18 gallons of oil in a cask; 4 gallons leaked out, and 11 were drawn out; how many gallons remained in the cask? 14 gallons more were put in; how many were then in the cask? How many less than at first?

7. A man walked 3 miles before breakfast, 9 miles between breakfast and dinner, and 8 miles after dinner; how many did he walk in all? How many more before than after dinner? How many more after breakfast than before?

8. A man picked in one pasture 6 quarts of berries, in another 7, and in another 4; and after selling 4 quarts to one person, and 3 to another, he picked 3 more; how many had he then? How many less than before he sold any?

9. A fruiterer had 20 apples; at one time he sold 3 of them for 4 cents, at another he sold 4 of them for 5 cents, at another 1 for 2 cents, and at another 2 for 2 cents; how many apples had he left? How much did he get for what he sold?

10. A person bought some rye for 5 dollars, some oats for 3 dollars, some barley for 3 dollars, and some wheat for 7 dollars; how many dollars *did he pay* for the whole? He gave in payment a *twenty* dollar bill; how much money ought he to *receive* in return? On measuring the grain, h

found there were 4 bushels of rye, 8 bushels of oats, 5 bushels of wheat, and 3 of barley; how many bushels of grain were there?

11. Frank has money enough to buy a pencil for 3 cents, a pen for 6 cents, some ink for 4 cents, and an inkstand for 6 cents; how many cents has Frank in all? Nancy has money enough to buy a pen and an inkstand like Frank's, and 5 cents' worth of paper; how much money has she? How much less than Frank?

12. Isaac and Francis were playing ball with Augustus and Reuben; Isaac batted the ball 11 times, and Francis batted it 9 times; Augustus batted it 10 times, and Reuben 7; how many times did Isaac and Francis bat it? How many times did Augustus and Reuben bat it? Isaac caught the ball 9 times, and Francis caught it 7 times; Augustus caught it 9 times, and Reuben caught it 10 times; how many more times did Augustus and Reuben catch it than Isaac and Francis?

13. A fisherman found on counting his fish, that he had caught 7 perch, 4 trout, and 7 pickerel; how many fish had he caught? He sold 2 of the perch for 5 cents, and the rest of them for 13 cents, and gave the money he thus received, for the use of the boat; how much did he pay for the use of the boat? He sold one trout for 4 cents, another for 5 cents, another for 7 cents, and the other for 4 cents; with the money he got for them, he bought a pole 9 feet long, and a line 9 feet long; how much did he pay for the pole and line? What was the length of the pole and line? He sold one of the pickerel for 8 cents, another for 9, and kept the rest of them; how many did he keep? How much did he receive for those he sold?

14. Mr. Gay had 6 dollars, he has since received

9 dollars, spent 10 dollars for broadcloth, received an old debt of 2 dollars, found 2 dollars, received 7 dollars for work, paid 8 dollars for a barrel of flour, 2 dollars for a barrel of apples, and lost 6 dollars; how many dollars has he now?

15. Three idle boys, Thomas, Joseph, and Samuel, were disputing about their examples; Samuel said he performed 6 examples on Monday, 3 on Tuesday, and 5 on Wednesday; Joseph said he performed 3 on Monday, 5 on Tuesday, and 6 on Wednesday; Thomas said he performed 6 on Monday, 3 on Tuesday, and 5 on Wednesday. Each thought he had done more than either of the others, so they quarrelled about it; now can you tell who had done the most? William, who was an industrious boy, performed 20 examples on Monday; how many more did he perform on that day than Thomas? than Joseph? than Samuel? How many more than each of the others performed in the three days?

16. I had 17 dollars this morning; I have since bought a hat for 4 dollars, and a pair of boots for 5 dollars. I have also received 11 dollars which a friend owed me, and paid a debt of 7 dollars; now tell me, if you can, how much money I have.

17. A little boy found 6 chestnuts under one tree, 4 under another, and 8 under another; he gave 5 of them to his mother, and 6 to his father; how many did he have left? The next day he found 12, which, with those he had left the day before, he put upon the hearth to roast; three of them, however, got burned; how many were then left?

18. Mr. Davol has in his orchard 7 apple trees, 2 pear trees, 8 peach trees, and 3 plum trees; how *many trees* has he in his orchard? From one and *tree he picked* 2 barrels of apples, from an

3 barrels, from another 0 barrels, from another 2 barrels, from another 6 barrels, from another 3 barrels, and from the other 4 barrels; how many barrels of apples did he pick from all? From one of his pear trees he picked 7 bushels of pears, and from the other he picked 5 bushels; how many did he pick from both trees? From his peach trees he picked 13 bushels of peaches; and from his plum trees he picked 4 bushels of plums; how many bushel baskets will be required to contain the peaches and plums? He sold some peaches for 13 dollars, and some plums for 5 dollars; how much did he get for both? He sold 3 barrels of apples for 6 dollars, 5 barrels for 9 dollars, 3 barrels for 5 dollars, and kept the rest; how many barrels of apples did he sell? How many did he keep? How much did he get for those he sold? He sold 2 bushels of pears for 3 dollars, 4 bushels for 6 dollars, 2 bushels for 3 dollars, and after selling the rest, he found he had received 18 dollars for the pears; how many dollars did he receive for the last lot? How many bushels were there in the last lot?

19. Susan and Mary had each 9 oranges; Susan gave 5 of hers to Mary, and Mary ate 2; they then put what they had left together, intending to keep them till the next week, but before that time, 4 of them had spoiled; they so divided the good ones between them that Mary had 6; how many did Susan have?

20. Laura had a party one afternoon; 3 girls came at one time, 4 at another, 2 at another, 5 at another, 3 at another, and finally came 2 twin sisters; how many girls came in all? 2 of them left before supper, and 3 of them immediately after; the *rest left* at nine o'clock; how many left at nine *o'clock?* At supper, three of them drank tea, and

the rest did not; how many did not? 2 of the girls that staid till nine o'clock, and all those that went home before that time, attend the grammar school; the rest attend the high school; how many attend the grammar school? How many the high school? How many more of the whole party, including Laura, who goes to the high school, attend that, than the grammar school?

REMARKS INTRODUCTORY TO MULTIPLICATION AND DIVISION.

If the pupil has been thoroughly trained upon the preceding sections, he will be able to master the following without difficulty. Indeed, multiplication is but another method of obtaining results that might be obtained by addition; and a product in multiplication may be regarded as a number representing the sum which would result from taking the multiplicand as many times as there are units in the multiplier.

By division we can determine two distinct things; first, into how many parts of a given size a given number can be separated; second, how many there will be in each part, obtained by separating some given number into a given number of equal parts. The nature of the example to be performed is the only thing that will determine which of these results is required, but the same process will give either of them. We have, however, deferred giving practical examples requiring the second, till the sections *on fractions* are reached.

Taking the first definition, then, it is evident, that

by adding the divisor to itself a sufficient number of times to produce the dividend, and then counting the number of times the divisor has been repeated, or by subtracting the divisor as many times as possible from the dividend, and then counting the subtractions, the *quotient* would be determined. This being the case, the most difficult step towards multiplication and division has already been taken, and the pupil has now little to do, except to learn the meaning of the technical expressions peculiar to these operations, and to commit to memory some of the results of his labors in addition.

An illustration like the following will give an idea of the nature of multiplication, and the meaning of the word *times*, as there used. Let a member of the class bring to your desk any convenient counter, say a pebble, and then ask some such questions, as the following; "How many times have you brought one pebble to my desk?" "How many times one pebble have you brought?" "How many pebbles?" "Then once one pebble is how many pebbles?" Let another be brought, and ask, "How many times one pebble have you now brought?" "How many pebbles?" "Then two times one pebble are how many pebbles?

A variety of illustrations will doubtless suggest themselves to the teacher, and they should be given; the best are those in which the *pupil* performs the operations on things.

In the multiplications, the pupil should be taught to deduce each product from a preceding one. Suppose he has reached the question, "How many are three times two?" his reasoning may be, "Three times two is one more two than two times two; two *times two* are four, four and two are six; therefore, *three times* two are six."

Here, as elsewhere, the class should be taught to form practical examples, involving the operations given on the abstract numbers; they will readily do it after the following models. How much will three apples cost at two cents apiece? If a man walk four miles in one hour, how many miles will he walk in two hours? How many pears at two cents apiece can you buy for six cents? &c., &c.

The first questions in section thirteenth are intended to lead to a knowledge of the method of proceeding, when the desired division cannot be exactly performed, and to the nature of remainders. The word *multiple* introduced into these questions, should be more fully explained and illustrated.

SECTION X.

A. 1. How many are once 1? 2 times 1?
2. Once 2? 3 times 1? Once 3? 4 times 1?
3. Once 4? 5 times 1? Once 5? 6 times 1?
4. Once 6? 7 times 1? Once 7? 8 times 1?
5. Once 8? 9 times 1? Once 9? 2 times 2?
6. 3 times 2? 2 times 3? 4 times 2? 2 times 4?
7. 3 times 3?

B. 1. How many times 1 = 2? times 1 = 6?
2. times 2 = 4? times 5 = 5? times 1 = 7?
3. times 1 = 3? times 4 = 8? times 3 = 6?
4. times 1 = 9? times 2 = 8? times 1 = 8?
5. times 2 = 6? times 2 = 4? times 3 = 9?

C. 1. 1 = how many times 1?
2. 2 = how many times 1? 2?
3. 3 = how many times 1? 3?
4. 4 = how many times 1? 2? 4?
5. 5 = how many times 1? 5?

6. 6 = how many times 1? 2? 3? 6?
7. 7 = how many times 1? 7?
8. 8 = how many times 1? 2? 4? 8?
9. 9 = how many times 1? 3? 9?

D. 1. 2 times what = 8? 3 times what = 6?
2. Once what = 5? 7 times what = 7?
3. 2 times what = 4? 3 times what = 9?
4. 8 times what = 8? Once what = 9?
5. 4 times what = 8? 2 times what = 6?

E. 1. 5 times 1, plus 4, divided by 3, less 1, plus 2, multiplied by 2, plus 1, less 3, = how many times 2?

2. 5 plus 3, divided by 4 plus 1, multiplied by 3, less 5, divided by 2, = what number?

3. 7 less 1, divided by 2, multiplied by 3, less 4, plus 3, divided by 8, less 1, = what?

4. 9 divided by 3, less 1, multiplied by 3, plus 1, plus 1, divided by 2, divided by 2, = how many times 1?

5. Once 2, plus 7, divided by 3, less 1, plus 2, multiplied by 2, less 5, multiplied by 3, less 7, multiplied by 3, plus 1, less 3, multiplied by 2, divided by 4, = how many times 2?

F. 1. Granville bought 4 pencils at 2 cents apiece; how much did they cost him?

Solution. If 1 pencil cost 2 cents, 4 pencils must have cost 4 times 2 cents, and 4 times 2 cents are 8 cents; therefore, 4 pencils at 2 cents apiece, cost 8 cents.

2. Andrew had some little baskets that held 3 quarts each; on Monday he picked berries enough to fill 3 of his baskets, and on Tuesday enough to *fill 2 of them*; how many quarts of berries did he *pick on* Monday? How many on Tuesday? How *many on* both days?

3. Frank can gather 2 baskets of chips in an hour, Reuben can gather 3, and Joel can gather 4 how many baskets of chips can Frank gather in 5 hours? Can Reuben? Can Joel? Can all together?

4. Amos sold 2 oranges at 3 cents apiece; how much did he get for them? With the money he received for the oranges he purchased apples at 2 cents apiece; how many apples did he purchase?

Solution. If he sold 1 orange for 3 cents, he must have sold 2 oranges for 2 times 3 cents, and 2 times 3 cents are 6 cents; therefore, he received 6 cents for 2 oranges at 3 cents apiece. Now, if for 2 cents he can buy 1 apple, for the 6 cents he received for his oranges he can buy as many apples as there are times 2 cents in 6 cents; and 2 cents are contained in 6 cents 3 times; therefore, he can buy 3 apples at 2 cents apiece, for the money he would get for 2 oranges at 3 cents apiece.

5. Angeline bought 3 yards of tape at 2 cents a yard; how much did it cost her? She sold it for 3 cents a yard; how much did she receive for it? She spent 8 of the cents she received for the tape for pears at 2 cents apiece; how many had she left? How many pears did she buy?

6. William, who had 17 apples, gave to his 2 brothers 4 apples apiece; how many did he give to both? How many had he left? He exchanged those he had left for oranges, giving 3 apples for an orange; how many oranges did he get?

7. If in 1 quart there are 2 pints, how many pints are there in 3 quarts? A man who had 3 quarts of milk, sold 2 quarts of it; how many *pints* did he sell? How many pints has he left? If in 1 *pint there* are 4 gills, how many gills has he left?

8. If a man can walk 3 miles in one hour, how many hours will it take him to walk 9 miles?

9. John can travel 2 miles in an hour, James can travel 3 miles, and William 4 miles; how many miles can John travel in 2 hours? Can James? Can William? How many hours would it take James to travel as far as John can travel in 3 hours? How many hours will it take John to travel as far as William can travel in 2 hours?

10. Sarah buys 3 little picture books at 2 cents apiece; how much does she pay for them? There are 2 pictures in each book; how many pictures are there in all the books?

SECTION XI.

A. 1. 10 times 1? Once 10? 5 times 2?
2. 2 times 5? 6 times 2? 2 times 6?
3. 7 times 2? 2 times 7? 4 times 3?
4. 3 times 4? 5 times 3? 3 times 5?

B. 1. How many times 2 = 12? 14? 10?
2. How many times 3 = 12? 15?
3. How many times 4 = 12?
4. How many times 7 = 14?
5. How many times 5 = 15? 10?

C. 1. 10 = how many times 1? 2? 5? 10?
2. 12 = how many times 4? 2? 3? 6?
3. 14 = how many times 2? 1? 7?
4. 15 = how many times 3? 5?

D. 1. 2 times what = 10? 2 times what = 14?
2. 2 times what = 12? 3 times what = 12?
3. 7 times what = 14? 3 times what = 15?

4. 6 times what = 12? 5 times what = 15?
5. Once what = 13? 11 times what = 11?
6. 4 times what = 12? 5 times what = 10?
7. 12 times what = 12? Once what = 14?

E. 1. 5 times 2, plus 2, divided by 3, multiplied by 2, plus 7, divided by 5?

2. 2 times 7, plus 6, less 8, divided by 2, plus 8, are how many times 2?

3. 4 times 3, less 3, divided by 3, multiplied by 5, plus 4, = how many?

4. 15 divided by 3, plus 3, plus 4, divided by 4, less 1, multiplied by 7, less 4, less 1, divided by 3, less 2, multiplied by 8, = how many times 4?

5. 7 plus 5, divided by 2, divided by 2, plus 2, multiplied by 3, less 4, plus 3, = how many times 2?

6. 13 less 3, divided by 5, plus 4, plus 6, divided by 4, multiplied by 2, plus 1, multiplied by 2, plus 1, = how many times 5?

F. 1. Saba bought 4 yards of ribbon at 3 cents a yard; how much did it cost her? After paying for it she had 8 cents left; how many cents had she at first? How much ribbon at 2 cents per yard, can she buy with the money she has left?

2. A man spends 15 cents a day for newspapers at 5 cents apiece; how many papers does he buy each day? How many papers will he buy in 2 days? In 3 days? In 4 days? In 5 days?

3. A man bought for his breakfast 4 cakes at 3 cents apiece; how much did his breakfast cost him? For his dinner he bought 2 loaves of bread at 6 cents a loaf, and 2 cakes at 3 cents apiece; how *much did* his dinner cost him? For his supper he *bought 2* pieces of pie at 5 cents apiece; how much

did his supper cost him? How much more did his dinner cost than his breakfast? Than his supper?

4. Mr. Mitchell earns 3 dollars per day, Mr. Swain 2 dollars, and Mr. Holmes 4 dollars; how many dollars will Mr. Mitchell earn in 3 days? Will Mr. Swain? Will Mr. Holmes? How many days will it take Mr. Swain to earn as many dollars as Mr. Mitchell earns in 4 days? How many days will it take Mr. Holmes to earn the same?

5. Matilda gave 3 of her companions 5 pictures apiece, and then had 5 pictures left; how many had she at first?

6. A news-boy sold 2 papers at 3 cents apiece, and 2 papers at 4 cents apiece; with the money he received, he bought some papers at 2 cents apiece; how many papers did he buy?

7. A farmer has 2 cows each of which gives 7 quarts of milk a day, and one which gives only 6 quarts a day; how many quarts do all give? He sells 3 quarts per day to Mrs. Gordon, and 2 quarts to Mrs. Curtis, keeping the rest; how many quarts does he keep? How many cents does he receive for what he sells, if he gets 4 cents per quart?

8. If there are 4 quarts in a gallon, how many quarts are there in a vessel containing 3 gallons and 3 quarts? How many quarts will remain in the vessel after 9 quarts have been drawn out? How many pints?

9. Mr. Dean sold to one man 8 quarts of molasses, to another 12 quarts, to another 4 quarts, and to another 12 quarts; how many *gallons* of molasses did he sell to the first man? To the second? To the third? To the fourth? How many gallons did he sell to all?

10. *Bought* 5 ounces of cloves at 3 cents an *ounce, and then* had 5 cents left; how many cents

had I at first? I spent one of the cents I had for a bunch of matches, and the rest for cinnam at 2 cents an ounce; how many ounces of cinnar did I buy?

11. Marietta gets 3 merit marks for every g geography lesson, and 2 for every good arithm lesson; how many merit marks will she get fc good lessons in geography and 5 in arithmetic?

SECTION XII.

A. 1. 8 times 2? 2 times 8? 9 times 2?
2. 2 times 9? 10 times 2? 2 times 10? 6 time:
3. 3 times 6? 4 times 4? 5 times 4? 4 time:

B. 1. How many times 2 = 20? 18? 1
2. How many times 3 = 18?
3. How many times 4 = 16? 20?
4. How many times 5 = 20?
5. How many times 6 = 18?
6. How many times 9 = 18?
7. How many times 10 = 20?

C. 1. 16 = how many times 2? 4? 8?
2. 18 = how many times 2? 3? 6? 9
3. 20 = how many times 2? 4? 5?

D. 1. 2 times what = 16? 3 times what =
2. 2 times what = 20? 5 times what =
3. Once what = 19? 4 times what =
4. 4 times what = 20? 9 times what =
5. 8 times what = 16? 10 times what =
6. 17 times what = 17? 2 times what =
7. 6 times what = 18? Once what = 1

E. 1. 6 times 3, plus 2, divided by 4,

multiplied by 2, divided by 4, = how many times 2?

2. 10 times 2, divided by 5, multiplied by 2, multiplied by 2, plus 2, divided by 3, plus 8, = how many times 2?

3. 5 times 4, less 2, divided by 6, plus 5, multiplied by 2, plus 2, divided by 9, multiplied by 8, divided by 4, = how many?

4. 10 plus 8, divided by 3, divided by 3, multiplied by 7, less 2, less 3, less 1, divided by 2, multiplied by 5, = how many times 2?

5. 17, less 8, divided by 3, plus 7, divided by 2, multiplied by 3, plus 3, divided by 9, plus 12, divided by 2, plus 5, divided by 3, multiplied by 4, = how many times 8?

6. 20 divided by 5, divided by 2, multiplied by 9, less 4, divided by 2, plus 9, divided by 2, plus 7, divided by 3, divided by 5, less 1, = how many?

F. 1. Mr. Fisher's horse travels 9 miles per hour; how many miles will he travel in 2 hours? Mr. Gay's horse travels 6 miles per hour; how many hours will it take him to travel as far as Mr. Fisher's horse travels in 2 hours?

2. In one quart there are 2 pints; how many pints are there in a dish containing 10 quarts? If from such a dish 4 pints were taken, how many pints would remain in the dish? how many quarts?

3. If a pint of molasses is worth 4 cents, what are 2 quarts worth?

4. A man has some grain in 2 bins; in each bin there are 10 bushels; how many bushels are there in both bins? If he put his grain into bags, putting 4 bushels into a bag, how many bags can he fill? If he sell 3 bags of the grain, how many bushels will *he have left?*

5. A man had 18 gallons of oil; he filled 2 three-gallon jugs from it, and put the rest into four-gallon jugs; how many four-gallon jugs did it require?

6. A boy had 13 cents; he did 2 errands, for each of which he received 3 cents, and he found 1 cent; how much money had he then? With his money he bought some pictures, at 4 cents apiece; how many pictures did he buy?

7. Abner and Lemuel were at a store together; their father told them they might each have either 7 oranges worth 2 cents apiece, or 6 oranges worth 3 cents apiece; Abner chose 6 oranges worth 3 cents apiece, and Lemuel chose 7 oranges worth 2 cents apiece; which were worth the most, Abner's oranges, or Lemuel's? How much the most?

8. A woman has a jug which it costs her 16 cents to get filled with molasses, at 8 cents per quart; how many quarts does the jug hold? How many quarts of molasses will it take to fill her jug 10 times? How many gallons?

9. How many shillings will 9 yards of cloth cost, at 2 shillings per yard? How many dollars, if it takes 6 shillings to make a dollar?

A lady had just money enough to buy 4 yards of cloth, at 2 shillings a yard; she concluded, however, to buy only 1 yard of the cloth, and to keep the rest of her money; how many dollars had she to keep?

10. A lady bought some cloth for 3 dollars, and then had 2 shillings left; how many shillings had she at first?

11. How much wheat, at 8 shillings a bushel, can be bought for 2 dollars and 4 shillings?

12. Bought 9 yards of cloth, at 2 shillings per *yard; how* many dollars did it cost?

13. How many thimbles, at 3 cents apiece, can *be bought* for a dime and a half dime?

14. Lucius is shelling corn into a 3 peck measure, which he empties into a bin large enough to hold 4 bushels and 2 pecks; how many measurefuls will be required to fill the bin?

15. I wish to put up 7 quarts and 1 pint of berries in boxes, so that each box shall contain 3 pints; how many boxes will be required?

16. At 4 cents apiece, how many pencils can be bought for 2 dimes?

17. How many bushels of potatoes at 7 shillings per bushel can a man buy for 2 dollars and 2 shillings?

18. How many gallons of oil are there in 8 vessels, each containing 2 quarts and 1 pint?

SECTION XIII.

A. 1. What numbers, not greater than 20, are multiples of 1; that is, can be made by using ones only?

2. What numbers, not greater than 20, are multiples of 2? of 3? of 4? of 5? of 6? of 7? of 8? of 9? of 10?

3. What numbers, divided by 2, leave no remainder?

Ans. The multiples of 2, which, as far as 20, are 2, 4, 6, 8, &c.

4. What numbers, divided by 4, leave no remainder? Divided by 5? by 7? by 10? by 8? by 3? by 9? by 6?

5. What numbers, divided by 3, leave a remainder?

Ans. Those which are not multiples of 3; and as far as 20, they are 1, 2, 4, 5, 7, 8, 10, 11, &c.

6. What numbers, divided by 7, leave a remainder? Divided by 9? by 2? by 6? by 8? by 10? by 4? by 5?

7. What is the largest multiple of 2, less than the number 9?

Ans. 8; which is the fourth multiple of 2.

8. What is the largest multiple of 3, less than the number 7? of 2? of 4? of 5? of 6?

9. What is the largest multiple of 4, less than the number 13? of 5? of 10? of 9? of 6? of 7? of 2? of 3? of 8?

10. What is the largest multiple of 2, less than 19? of 3? of 4? of 5? of 6? of 7? of 8? of 9? of 10?

11. What is the largest multiple of 6, less than the number 17? of 9? of 4? of 2? of 8? of 10? of 3? of 5? of 7?

12. What is the largest multiple of 7, less than the number 15? of 4? of 2? of 10? of 8? of 9? of 6?

B. 1. 9 are how many times 2?

Ans. 4 times 2, and 1 over; because 4 times 2 are 8, and 1 are 9.

2. 9 are how many times 4? 5? 2? 7? 6? 8? 9? 3?

3. 7 are how many times 2? 1? 7? 4? 5? 3? 6?

4. 8 are how many times 3? 2? 4? 5? 6? 7?

5. 11 are how many times 8? 10? 2? 7? 4? 9? 6? 3? 5?

6. 14 are how many times 7? 2? 6? 10? 8? 3? 9? 4? 5?

7. 18 are how many times 2? 3? 4? 5? 6? 7? 8? 9? 10?

8. 10 are how many times 9? 7? 3? 5? 8? 2? 6? 4? 10?

9. 15 are how many times 5? 3? 4? 10? 9? 6? 7? 2? 8?

10. 13 are how many times 10? 3? 7? 5? 8? 9? 6? 2? 4?

11. 12 are how many times 2? 6? 9? 8? 5? 7? 10? 3? 4?

12. 17 are how many times 10? 9? 8? 7? 6? 4? 3? 2? 1?

13. 19 are how many times 1? 3? 5? 7? 9? 10? 8? 6? 4? 2?

14. 16 are how many times 3? 4? 2? 8? 10? 9? 7? 5? 6?

15. 20 are how many times 10? 2? 4? 5? 7? 3? 9? 8? 6?

C. 1. Agnes has 8 cents, with which she wishes to buy oranges at 3 cents apiece; how many oranges can she buy, and how many cents will she have left?

Solution. If for 3 cents she can buy one orange, for 8 cents she can buy as many oranges as there are times 3 cents in 8 cents; and 3 cents are contained in 8 cents 2 times, and there are 2 cents remaining; therefore, for 8 cents she can buy 2 oranges at 3 cents apiece, and she will have 2 cents left.

Or, by *Solution* 2d. If she can buy 1 orange for 3 cents, she can buy as many oranges as she has times 3 cents; she has 8 cents, and 8 are 2 times 3, and 2 over; therefore, she can buy 2 oranges, and she will have 2 cents left.

2. If 1 loaf of bread costs 5 cents, how many *loaves can* a man who has 17 cents pay for? Can *a man who* has 13 cents? 15 cents? 9 cents?

3. Mr. Manchester had 15 dollars; he b as many barrels of flour, at 6 dollars per barr he could pay for with the money, and then what he had left for corn; how many barrels of did he buy? How many dollars had he l spend for corn? How many shillings?

4. A person who owes 14 dollars, wishes t as much of the debt as possible, in three-dollar and the rest in one-dollar bills; how many bi each sort must he pay?

5. Samuel has picked 11 quarts of berries, v he wishes to send to market in two-quart b how many boxes can he fill?

6. William did 4 errands, for each of whi received 3 cents, and he had 8 cents before h the errands; he bought as many writing book cents apiece, as he could pay for, and spent th of his money for pens, at 2 cents apiece; how writing books did he buy? How many cent he left to buy pens with? How many pens d buy?

7. A person who had 20 cents, said to a "If you will tell me how many loaves of bread cents a loaf, I can buy with my money, I will you what there will be left after paying fo bread." The boy answered right; what wa answer? How many cents must the person him?

8. A milkman has 20 quarts of milk in e quart cans; all the cans but one are full; how m cans are full? How many quarts are there in can which is not full?

9. A fruiterer bought 15 apples, at the rate *for a cent;* how much did they cost? If he *them at* the rate of 2 for a cent, how many *will he get* for them?

10. If 3 feet are equal to one yard, and if it takes 1 yard of cloth to make an apron, how many aprons can be made from a piece of cloth 11 feet in length?

11. If it requires 3 yards of broadcloth to make a coat, how many coats can be made from a piece containing 8 yards of broadcloth? How many yards will remain after making the coats? If 1 yard of the cloth will make 3 vests, how many vests can be made from the cloth left after making the coats?

12. Mr. Stevens has 18 dollars, with which he wishes to buy some flour at 10 dollars per barrel, some apples at 3 dollars per barrel, and some corn at 1 dollar per bushel. He wishes first, to buy as many barrels of flour as he can pay for, then as many barrels of apples as he can pay for, and then to spend the rest of his money for corn; how many barrels of flour can he buy? How many barrels of apples? How many bushels of corn? How many dollars will he spend for each?

13. Mr. Cook bought 2 gallons and 2 quarts of molasses, with which he filled as many three-quart jugs as he could, giving what there was left after filling the jugs, to a candy woman; how many jugs did he fill? How many quarts of molasses did the candy woman have? If from one pint of molasses, she can make 9 sticks of candy, how much can she make from the molasses Mr. Cook gave her? If she sells her candy at 1 cent per stick, and if with the money she thus receives, she buys bread at 5 cents a loaf, how many loaves of bread can she buy? How many cents will she have left?

14. Lyman has 8 cents, Chester has 10 cents, Horace has 13 cents, and Isaac has 7 cents; each *agrees to* buy as many oranges, at 3 cents apiece, *as he can* pay for, and to give the rest of his money

to a poor woman; how many oranges can each buy, and how many cents will each have left to give to the poor woman? How many oranges will all the boys have? How many cents will all give the poor woman?

SECTION XIV.

To THE TEACHER. — The subjects of *factors*, *multiples*, and *divisors*, though somewhat abstract and difficult in their nature, are quite too important in their applications to be omitted. We trust the arrangement is such as to suggest the processes and the modes of illustration. The pupil's attention should be particularly directed to the fact that any number is a factor of all its multiples, and a multiple of all its factors; that *one* is a factor of all entire numbers, that dividing by it alters neither the form or the value of a number, and that, for these reasons, it need not be written with the factors of a number; also, that if a number be a factor of another number, *it* will be a factor of all multiples of that other number.

A. 1. What are the factors of a number?

Ans. The factors of a number are those numbers which multiplied together give that number for a product; thus, the factors of 12 are 12 and 1, 6 and 2, and 4 and 3; because 12 times 1, 6 times 2, and 4 times 3, will each give 12 for a product.

2. What are the factors of 1? 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? 13? 14? 15? 16? 17? 18? 19? 20?

3. Write all the factors of the numbers from 1 to 20, as in the following models: $1 = 1 \times 1$; $2 = 2 \times 1$; $3 = 3 \times 1$; $4 = 4 \times 1 = 2 \times 2$.

4. Of what numbers do you find 1 to be a factor? 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? 13?

5. *If 1 be taken as one of the factors of a number, what will* always be the corresponding factor?

6. What is the difference between a prime and a composite number?

Ans. A prime number is a number which has no factors except itself and 1; a composite number is a number which has other factors besides itself and 1; thus, 5 is a prime number, because its only factors are 5 and 1; 6 is a composite number, because it has other factors (3 and 2) besides 6 and 1.

7. Is 1 a prime or a composite number, and why? Is 2, and why? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? 13? 14? 15? 16? 17? 18? 19? 20?

8. When is a number said to be divided into its prime factors?

Ans. When it is divided into factors which are all prime numbers.

9. What are the prime factors of 3? 4? 5? 6? 9? 15? 18? 20? 12? 7? 16? 14? 10? 8? 17?

10. By what prime numbers must any number which is divisible by 6 be divisible?

Solution. Every number which is divisible by 6 can be made by using sixes only, and every time 6 is taken its factors must be taken; it follows, therefore, that any number which is divisible by 6 must be divisible by the prime factors of 6, which are 3 and 2.

11. By what prime numbers must any number which is divisible by 10 be divisible? by 14? by 4? by 8? by 9? by 12?

12. What are the only prime factors which any divisor of 18 can contain?

Ans. The prime factors of 18, which are 2, 3, and 3; and any number which contains a part or all of these, and no others, will divide 18.

13. What are the only prime factors which any *divisor of 15* can contain? of 16? of 9? of 20? of 4? of 6? of 12? of 14? of 10? of 8?

14. What is a common divisor of two or mo numbers ?

Ans. A number which will divide them all wi out a remainder.

15. What is the greatest common divisor of t or more numbers ?

Ans. The largest number that will divide th all without a remainder.

16. What is the greatest common divisor of and 18 ?

Ans. The number obtained by multiplying gether all the prime factors which are found in b 12 and 18;

$$12 = 2 \times 2 \times 3.$$
$$18 = 2 \times 3 \times 3.$$

2 and 3 are the only common factors, and theref 2 times 3, which equals 6, is the greatest comm divisor of 12 and 18.

17. What is the greatest common divisor of and 20 ? Of 15 and 9 ? Of 8 and 12 ? Of 7 a 14 ? Of 3 and 5 ? Of 7 and 11 ? Of 3 and 1 Of 19 and 7 ? Of 4 and 18 ? Of 6, 12, and 1 Of 8, 12, and 20 ? Of 9, 15, and 6 ? Of 3, 9, a 12 ? Of 8 and 20 ? Of 9 and 18 ? Of 8, 12, a 20 ?

18. What is a common multiple of two or mo numbers ?

Ans. Any number which is a multiple of all them.

19. What is the least common multiple of or more numbers ?

Ans. The least number which is a multipl all of them.

20. What is the least common multiple *and 4 ?*

Solution. The least common multiple o

4 must be the smallest number that contains all the factors of 6 and 4.

$$6 = 3 \times 2.$$
$$4 = 2 \times 2.$$

In taking the factors of 6, we take one factor, 2, of 4; and hence, if we put with the factors of 6, the other factor of 4, which is 2, we shall have the prime factors of both 6 and 4; the product, therefore, of $3 \times 2 \times 2$, which is 12, is the least common multiple of 6 and 4.

21. What is the least common multiple of 4 and 10? Of 6 and 9? Of 4 and 8? Of 10 and 20? Of 3, 6, and 9? Of 4, 8, and 16? Of 3 and 5? Of 4, 5, and 20? Of 4, 12, and 16? Of 6, 2, 3, and 4?

FRACTIONS.

By proper illustrations and explanations of the use of fractions, we think that the difficulties usually encountered by beginners will be easily overcome. Some method of oral instruction like the following may commend itself to the teacher.

Exhibit any convenient thing, as an apple, to the class, and cutting it into two equal parts, ask, What have I done to this apple?

Pupil. You have cut it.

Teacher. Into how many parts have I cut it?

P. Into two parts.

T. How do the parts compare in size?

P. They are equal in size.

T. Then how have I cut the apple?

P. Into two equal parts.

T. When anything is divided into two equal parts, the parts are called halves of the thing; what then shall I call the parts of this apple?

P. Halves of the apple.

T. What shall I call one of the parts?

P. One half of the apple.

T. What shall I call both of the parts?

P. Two halves of the apple.

T. To what are both together equal?

P. To a whole apple.

T. Then how many halves of an apple are equal to a whole one?

P. Two halves of an apple.

T. If I should divide another apple into halves, how many halves would it make?

P. Two halves.

Cutting another apple into halves, ask, "How many halves have I from two apples?"

Dividing apples or other things into thirds, fourths, fifths, &c., continue such questions and illustrations as the above, till the class become familiar with the nature of fractions. They may then commence the study of the following sections:

The operations required in sections 15 and 16 do not differ in principle from, and are not more difficult than, those in whole numbers in the preceding sections. Thus; what greater difficulty in adding $\frac{1}{4}$ and $\frac{3}{4}$, and then ascertaining the number of whole ones in their sum, than in adding 5 quarts and 3 quarts together, and finding how many gallons they equal? Or in finding how many times $\frac{2}{3}$ equal $\frac{4}{3}$, or $1\frac{2}{3}$, than in finding how many times 2 feet equal 4 yards, or 12 feet?

In commencing the 17th section, the pupil should be taught to observe that the subject of the relation *of numbers* has a direct dependence upon the *preceding subjects*; for, since a thing is equal to two

halves, three thirds, four fourths, &c., of itself, one half must be one half of two times one half, one third must be one third of three times one third, &c.

The following questions, extended and illustrated by the teacher, will enable the pupil to comprehend the effect of either multiplying or dividing the denominator of a fraction.

"Which will be the larger, the parts obtained by dividing a thing into a large, or a small number of parts?"

"Suppose I have two things of the same size, and divide the first of them into a certain number of equal parts, and the second into twice as many equal parts; which will be the larger, the parts of the first, or of the second thing?"

Vary the above till it is well understood that the greater the number of parts into which a thing is divided, the smaller must be the size of one of the parts; then, applying this principle to written fractions, show that the effect of multiplying the denominator is to divide, and that the effect of dividing it is to multiply, the fraction.

The reduction of fractions to their lowest terms should always be insisted upon. The solution found in section 17 may be practised till it is well understood; after which, should be given the method of reducing fractions by dividing both numerator and denominator by the same number. To explain the last, let us suppose that $\frac{4}{8}$ is to be reduced; by dividing the numerator by 2, the fraction expresses only half as many parts as before, but by dividing the denominator by 2, each part becomes twice as large as before; hence the value of the fraction is unaltered.

By dividing numerator and denominator into their *factors*, we can show that every reducible fraction

made up of a reducible and an irreducible part, a that the reducible part may be cancelled; for exa ple, $\frac{4}{6} = \frac{2 \times 2}{2 \times 3} = \frac{2}{2} \times \frac{2}{3}$, or $\frac{2}{2}$ of $\frac{2}{3}$; but since equals the whole of a thing, $\frac{2}{2}$ of $\frac{2}{3}$ must equal t whole of $\frac{2}{3}$, and therefore $\frac{4}{6}$ must equal $\frac{2}{3}$.

In reducing fractions to a common denominat there are two distinct things to be done; first, determine what number to use for a common deno inator; second, To change the given fractions equivalent ones having this number for a denomi tor.

As far as the *denominator* is concerned, one nu ber may as well be taken for a common denomina as another; but unless a common multiple of t denominators is employed, the numerators of t resulting fractions will not be entire numbers. It also desirable to use as small numbers as possib For these reasons, it will usually be most convenie to employ for a common denominator the least co mon multiple of the given denominators. The things should be explained to the pupil, as likewi the necessity and use of the transformation.

Practical examples applying the abstract numb should be made by the pupils.

SECTION XV.

A. 1. When anything is divided into two eq parts, what are the parts called?

Ans. When anything is divided into two eq parts, the parts are called halves of the thing; o *of the parts is* called one half of the thing, and t *of them, two* halves, equal to the whole.

2. When anything is divided into three equal parts, what are the parts called? When it is divided into four equal parts? into five? into six? into seven? into eight? into nine? into ten? into eleven? into twelve?

3. What do you understand by halves of a thing?

Ans. Parts obtained by dividing the thing into two equal parts.

4. What do you understand by thirds of a thing? by fourths? by fifths? by sixths? by sevenths? by eighths? by ninths? by tenths? by elevenths? by twelfths?

Remark 1. The number employed to show into how many equal parts a thing is divided, is called the *denominator*, because it determines the size or *denomination* of the parts.

Remark 2. The number employed to *enumerate*, or show the number of parts considered or used, is called the *numerator*.

Remark 3. Fractions are usually expressed by writing the numerator over the denominator, and drawing a line between them; thus three fourths is written $\frac{3}{4}$, in which 3 is the numerator, and 4 the denominator.

5. What do you understand by $\frac{1}{2}$ (one half) of a thing?

Ans. One of the two equal parts into which the thing is divided.

6. What do you understand by $\frac{2}{3}$ (two thirds) of a thing?

Ans. Two of the three equal parts into which the thing is divided.

7. What do you understand by $\frac{3}{4}$ (three fourths) of a thing? by $\frac{5}{7}$ (five sevenths)? by $\frac{4}{9}$ (four ninths)? by $\frac{7}{10}$ (seven tenths)? by $\frac{9}{11}$ (nine elevenths)? by $\frac{7}{12}$ (seven twelfths)? by $\frac{8}{9}$? by $\frac{3}{5}$? by $\frac{5}{8}$? by $\frac{5}{12}$?

by $\frac{1}{6}$? by $\frac{3}{5}$? by $\frac{3}{10}$? by $\frac{5}{11}$? by $\frac{5}{13}$? by $\frac{2}{7}$? by $\frac{4}{9}$? by $\frac{3}{7}$?

8. What does the denominator, and what does the numerator, in each of the above-written fractions, show?

Ans. In the first, $\frac{3}{4}$, the denominator, 4, shows that a thing is divided into four equal parts, and the numerator, 3, that we consider but three of the parts. In the second, $\frac{5}{7}$, the denominator, 7, shows, &c.

9. How many halves make the whole of anything?

Ans. Two; because halves are parts obtained by dividing a thing into two equal parts.

10. How many fifths make the whole of anything? how many sevenths? twelfths? eighths? elevenths? sixths? thirds? tenths? fourths? ninths?

B. 1. $3 =$ how many halves?

Solution. One equals two halves; therefore, three must equal three times two halves, which are six halves. *Ans.*, $3 = \frac{6}{2}$.

In a similar manner, reduce

2. 2 to thirds. 5 to fourths. 6 to halves.
3. 10 to halves. 3 to sixths. 1 to thirteenths.
4. 2 to eighths. 5 to thirds. 4 to fifths.
5. 6 to thirds. 7 to halves. 2 to ninths.
6. 8 to halves. 9 to halves. 2 to fifths.
7. 2 to tenths. 4 to halves. 3 to fourths.

C. 1. $2\frac{3}{4} =$ how many fourths?

Solution. One equals four fourths; therefore, two must equal two times four fourths, which are eight fourths; and three fourths, added, make eleven fourths. *Ans.*, $2\frac{3}{4} = \frac{11}{4}$.

In a similar manner, reduce

2. $2\frac{1}{7}$ to sevenths. $4\frac{3}{4}$ to fourths. $1\frac{1}{12}$ to twelfths.
3. $1\frac{1}{19}$ to nineteenths. $4\frac{1}{4}$ to fourths. $1\frac{1}{2}$ to halves.

4. $2\frac{1}{3}$ to thirds. $5\frac{2}{3}$ to thirds. $2\frac{3}{8}$ to eighths.
5. $1\frac{5}{7}$ to sevenths. $2\frac{3}{5}$ to fifths. $5\frac{1}{3}$ to thirds.
6. $1\frac{2}{13}$ to thirteenths. $3\frac{3}{4}$ to fourths. $3\frac{4}{5}$ to fifths.
7. $4\frac{2}{3}$ to thirds. $6\frac{2}{3}$ to thirds. $5\frac{1}{2}$ to halves.
8. $7\frac{1}{2}$ to halves. $8\frac{1}{2}$ to halves. $1\frac{4}{15}$ to fifteenths.

D. 1. $\frac{4}{2}$ = how many whole ones?

Solution. Two halves equal one whole one; therefore, four halves must equal as many whole ones as there are times two halves in four halves, which are two times. *Ans.*, $\frac{4}{2} = 2$.

In a similar manner, reduce to whole numbers

2. $\frac{12}{4}$, $\frac{9}{3}$, $\frac{16}{4}$, $\frac{18}{3}$, $\frac{10}{5}$, $\frac{12}{6}$, $\frac{15}{5}$, $\frac{2}{2}$.
3. $\frac{5}{5}$, $\frac{18}{18}$, $\frac{14}{7}$, $\frac{8}{4}$, $\frac{7}{7}$, $\frac{12}{3}$, $\frac{16}{8}$.
4. $\frac{20}{4}$, $\frac{20}{5}$, $\frac{16}{2}$, $\frac{12}{6}$, $\frac{15}{3}$, $\frac{10}{2}$, $\frac{14}{2}$.

E. 1. $\frac{12}{5}$ = how many whole ones?

Solution. Five fifths equal one whole one; therefore, twelve fifths must equal as many whole ones as there can be times five fifths taken from twelve fifths; and five fifths can be taken from twelve fifths two times, and there will be two fifths remaining. *Ans.*, $\frac{12}{5} = 2\frac{2}{5}$.

In a similar manner, reduce to whole ones

2. $\frac{3}{2}$, $\frac{4}{3}$, $\frac{5}{4}$, $\frac{7}{6}$, $\frac{3}{3}$, $\frac{12}{7}$, $\frac{8}{4}$, $\frac{9}{7}$, $\frac{10}{3}$, $\frac{11}{2}$, $\frac{18}{7}$, $\frac{15}{4}$.
3. $\frac{19}{3}$, $\frac{11}{4}$, $\frac{18}{5}$, $\frac{18}{2}$, $\frac{11}{8}$, $\frac{13}{5}$, $\frac{14}{6}$, $\frac{19}{12}$, $\frac{8}{5}$, $\frac{7}{5}$.
4. $\frac{8}{6}$, $\frac{16}{3}$, $\frac{16}{9}$, $\frac{17}{8}$, $\frac{15}{11}$, $\frac{19}{7}$, $\frac{15}{10}$, $\frac{16}{6}$, $\frac{20}{14}$, $\frac{18}{4}$.

F. 1. $\frac{1}{3} + \frac{1}{3}$? $\frac{1}{8} + \frac{1}{8}$? $\frac{1}{7} + \frac{1}{7}$? $\frac{2}{7} + \frac{2}{7}$? $\frac{3}{8} + \frac{2}{8}$? $\frac{1}{8} + \frac{3}{8} + \frac{3}{8}$? $\frac{2}{5} + \frac{2}{5}$? $\frac{1}{9} + \frac{3}{9} + \frac{4}{9}$? $\frac{1}{11} + \frac{3}{11} + \frac{4}{11}$? $\frac{1}{12} + \frac{3}{12} + \frac{4}{12}$? $\frac{4}{17} + \frac{6}{17} + \frac{5}{17}$?

2. $\frac{3}{5} + \frac{4}{5} + \frac{4}{5}$? *Ans.*, $2\frac{1}{5}$.

3. $\frac{4}{7} + \frac{6}{7} + \frac{5}{7}$? $\frac{4}{8} + \frac{6}{8} + \frac{5}{8}$? $\frac{2}{3} + \frac{2}{3} + \frac{1}{3} + \frac{2}{3}$? $\frac{6}{9} + \frac{5}{9} + \frac{7}{9}$? $\frac{4}{6} + \frac{5}{6} + \frac{1}{6} + \frac{5}{6} + \frac{4}{6}$?

4. $\frac{5}{8} - \frac{1}{8}$? $\frac{5}{12} - \frac{1}{12}$? $\frac{5}{6} - \frac{1}{6}$? $\frac{10}{11} - \frac{6}{11}$? $\frac{10}{13} - \frac{6}{13}$? $\frac{10}{18} - \frac{6}{18}$? $\frac{15}{17} - \frac{8}{17}$? $\frac{15}{18} - \frac{8}{18}$? $\frac{8}{9} - \frac{4}{9}$? $\frac{13}{17} - \frac{4}{17}$? $\frac{17}{20} - \frac{14}{20}$? $\frac{14}{16} - \frac{8}{16}$? $\frac{4}{5} - \frac{2}{5}$? $\frac{6}{8} - \frac{5}{8}$?

5. $\frac{4}{8}+\frac{5}{8}-\frac{6}{8}+\frac{3}{8}+\frac{7}{8}+\frac{4}{8}-\frac{7}{8}?\ \frac{2}{3}+\frac{2}{3}+\frac{1}{3}-\frac{2}{3}?\ \frac{4}{12}+\frac{7}{12}+\frac{4}{12}-\frac{6}{12}-\frac{3}{12}+\frac{5}{12}?\ \frac{7}{16}+\frac{12}{16}-\frac{5}{16}-\frac{7}{16}+\frac{13}{16}?\ \frac{5}{6}+\frac{4}{6}+\frac{4}{6}-\frac{3}{6}-\frac{3}{6}+\frac{4}{6}?\ \frac{7}{20}+\frac{9}{20}-\frac{4}{20}+\frac{6}{20}-\frac{2}{20}-\frac{5}{20}-\frac{5}{20}?$

6. $3+\frac{2}{5}?\ 6+\frac{2}{3}?\ 7+\frac{4}{5}?\ 6+\frac{4}{7}?\ 2+\frac{4}{7}+3?\ 1+\frac{3}{5}+8?\ \frac{3}{3}+7+\frac{2}{3}?$

7. $4+\frac{5}{8}+\frac{7}{8}?\ \frac{3}{7}+4+\frac{2}{7}+3+\frac{5}{7}?\ 4\frac{1}{2}+2?\ 3\frac{2}{3}+8?\ 9\frac{4}{5}+4+\frac{3}{5}?\ \frac{5}{11}+\frac{8}{11}+6\frac{4}{11}?\ 1\frac{3}{10}+4\frac{9}{10}+2+8?\ 3\frac{7}{10}+6\frac{4}{10}+8\frac{9}{10}?\ 3\frac{5}{6}+2\frac{4}{6}+8\frac{4}{6}?\ 6\frac{3}{7}+8\frac{5}{7}+1\frac{6}{7}+\frac{6}{7}?\ 4\frac{2}{3}+3\frac{2}{3}+2\frac{1}{3}+4\frac{2}{3}?\ \frac{1}{3}+1\frac{2}{3}+2\frac{1}{3}+\frac{2}{3}+4\frac{1}{3}?\ 8\frac{3}{5}+5\frac{4}{5}+3\frac{2}{5}+2\frac{4}{5}?\ 3\frac{5}{8}+2\frac{1}{8}+3\frac{3}{8}+7\frac{5}{8}+2\frac{5}{8}?\ 1\frac{5}{9}+3\frac{7}{9}+5\frac{3}{9}+7?\ 2+3\frac{2}{11}+\frac{8}{11}+4\frac{4}{11}+6\frac{3}{11}?\ 6\frac{5}{12}+3\frac{1}{12}+2\frac{1}{12}+3+4\frac{1}{12}?\ 2\frac{1}{2}+5+7\frac{1}{2}+3\frac{1}{2}?$

8. $6\frac{3}{5}-4?\ 9\frac{4}{7}-8?\ 4\frac{5}{9}-3?\ 16\frac{2}{3}-3?\ 17\frac{4}{11}-8?\ 13\frac{2}{5}-5?\ 5\frac{1}{2}-3?\ 7\frac{2}{13}-2?$

9. $3\frac{5}{6}-\frac{1}{6}?\ 3\frac{5}{12}-\frac{1}{12}?\ 7\frac{5}{17}-\frac{1}{17}?\ 7\frac{8}{9}-\frac{1}{9}?\ 13\frac{16}{17}-\frac{4}{17}?\ 9\frac{17}{19}-\frac{14}{19}?\ 14\frac{11}{12}-\frac{4}{12}?$

10. $8\frac{6}{7}-3?\ 8\frac{6}{7}-\frac{2}{7}?\ 8\frac{6}{7}-3\frac{2}{7}?\ 9\frac{10}{11}-4?\ 9\frac{10}{11}-\frac{7}{11}?\ 9\frac{10}{11}-4\frac{7}{11}?\ 7\frac{7}{8}-4?\ 7\frac{7}{8}-\frac{2}{8}?\ 7\frac{7}{8}-4\frac{2}{8}?$

11. $1-\frac{1}{2}?\ 1-\frac{1}{6}?\ 1-\frac{5}{6}?\ 1-\frac{2}{6}?\ 1-\frac{4}{5}?\ 1-\frac{1}{8}?\ 1-\frac{3}{8}?\ 1-\frac{7}{11}?\ 1-\frac{4}{11}?\ 1-\frac{8}{11}?\ 1-\frac{5}{12}?\ 1-\frac{1}{12}?\ 1-\frac{6}{7}?\ 1-\frac{2}{3}?\ 1-\frac{1}{4}?\ 1-\frac{4}{5}?\ 1-\frac{2}{6}?\ 1-\frac{3}{5}?$

12. $1-\frac{1}{2}+1?\ 1+1-\frac{1}{2}?\ 2-\frac{1}{2}?\ 1-\frac{1}{3}+1?\ 1+1-\frac{1}{3}?\ 2-\frac{1}{3}?\ 1-\frac{1}{2}+2?\ 2+1-\frac{1}{2}?\ 3-\frac{1}{2}?\ 1-\frac{1}{3}+4?\ 4+1-\frac{1}{3}?\ 5-\frac{1}{3}?\ 1-\frac{3}{7}+4?\ 4+1-\frac{3}{7}?\ 5-\frac{3}{7}?\ 1-\frac{7}{8}+6?\ 6+1-\frac{7}{8}?\ 7-\frac{7}{8}?\ 4+1-\frac{7}{8}?\ 8+1-\frac{3}{7}?$

13. $9-\frac{3}{7}?\ 7-\frac{6}{7}?\ 4-\frac{2}{11}?\ 16-\frac{1}{2}?\ 14-\frac{3}{7}?\ 12-\frac{7}{12}?\ 8-\frac{2}{3}?\ 19-\frac{6}{7}?\ 2-\frac{19}{20}?\ 5-\frac{17}{19}?\ 2-\frac{2}{11}?\ 3-\frac{3}{11}?\ 7-\frac{7}{15}?$

16 — 6? 3 — 17/20? 2 — 8/9? 7 — 3/8? 5 — 1/2?

14. $5 - 1\frac{2}{7}$? $5 - 1\frac{2}{7}$? $8 - 3 - \frac{3}{11}$? $8 - 3\frac{3}{11}$? $17 - 8 - \frac{1}{8}$? $17 - 8\frac{1}{8}$? $13 - 2 - \frac{5}{12}$? $13 - 2\frac{5}{12}$? $7 - 3\frac{1}{5}$? $8 - 5\frac{2}{3}$? $16 - 8\frac{2}{7}$? $13 - 2\frac{2}{7}$? $11 - 6\frac{2}{7}$? $15 - 3\frac{2}{7}$? $8 - 4\frac{3}{5}$? $7 - 1\frac{1}{5}$? $13 - 8\frac{2}{3}$? $4 - 2\frac{3}{17}$? $8 - 5\frac{2}{3}$? $6 - 3\frac{1}{7}$? $20 - 5\frac{1}{7}$? $10 - 5\frac{1}{7}$? $18 - 6\frac{1}{3}$? $14 - 13\frac{3}{16}$? $15 - 9\frac{1}{2}$?

15. $1\frac{1}{3} - \frac{2}{3}$?

Solution. $1\frac{1}{3}$ is equal to $\frac{4}{3}$, and $\frac{4}{3}$ less $\frac{2}{3}$ equals $\frac{2}{3}$, the answer.

16. $1\frac{2}{5} - \frac{4}{5}$? $1\frac{4}{8} - \frac{6}{8}$? $1\frac{5}{12} - \frac{7}{12}$? $1\frac{8}{17} - \frac{16}{17}$? $1\frac{6}{11} - \frac{7}{11}$? $1\frac{7}{13} - \frac{8}{13}$? $1\frac{3}{8} - \frac{7}{8}$? $1\frac{7}{10} - \frac{9}{10}$?

17. $1\frac{3}{5} - \frac{4}{5} + 6$? $6 + 1\frac{3}{5} - \frac{4}{5}$? $7\frac{3}{5} - \frac{4}{5}$? $1\frac{5}{7} - \frac{6}{7} + 7$? $7 + 1\frac{5}{7} + \frac{6}{7}$? $8\frac{5}{7} - \frac{6}{7}$? $18\frac{3}{16} - \frac{7}{16}$? $14\frac{1}{19} - \frac{7}{19}$? $6\frac{1}{3} - \frac{2}{3}$? $12\frac{3}{5} - \frac{4}{5}$? $11\frac{1}{4} - \frac{3}{4}$? $18\frac{1}{6} - \frac{3}{6}$? $7\frac{1}{9} - \frac{8}{9}$? $3\frac{5}{7} - \frac{6}{7}$? $12\frac{3}{15} - \frac{13}{15}$? $9\frac{2}{5} - \frac{3}{5}$? $3\frac{1}{7} - \frac{6}{7}$? $2\frac{4}{13} - \frac{12}{13}$? $7\frac{8}{11} - \frac{10}{11}$?

18. $6\frac{1}{3} - 4 - \frac{7}{9}$? $6\frac{1}{3} - 4\frac{7}{9}$? $9\frac{3}{5} - 2 - \frac{5}{8}$? $9\frac{3}{8} - 2\frac{5}{8}$? $7\frac{3}{10} - 6 - \frac{9}{10}$? $7\frac{3}{10} - 6\frac{9}{10}$? $9\frac{1}{4} - 5\frac{3}{4}$? $16\frac{2}{7} - 12\frac{5}{7}$? $19\frac{1}{6} - 2\frac{4}{6}$? $18\frac{1}{17} - 1\frac{2}{17}$? $13\frac{5}{14} - 6\frac{13}{14}$? $7\frac{4}{9} - 2\frac{7}{9}$? $20\frac{3}{11} - 6\frac{5}{11}$? $13 - 4\frac{1}{6}$? $15\frac{2}{3} - 6\frac{1}{3}$? $6\frac{2}{7} - 3\frac{4}{7}$? $5\frac{4}{15} - 3\frac{5}{15}$? $7\frac{9}{10} - 1\frac{9}{10}$? $15\frac{3}{15} - 6\frac{4}{15}$? $8\frac{2}{7} - 2\frac{6}{7}$? $9\frac{1}{12} - 3\frac{2}{12}$? $8\frac{2}{4} - 3\frac{3}{4}$? $7\frac{1}{6} - 6\frac{5}{6}$? $5\frac{4}{8} - 3\frac{6}{8}$? $5\frac{4}{9} - 2\frac{5}{9}$? $12\frac{1}{12} - 11\frac{11}{12}$? $6\frac{1}{7} - 5\frac{8}{7}$? $8\frac{5}{9} - 3\frac{7}{9}$? $6\frac{8}{13} - 2\frac{4}{13}$? $9\frac{1}{3} - 2\frac{2}{3}$? $8 - 1\frac{4}{9}$?

19. $5\frac{5}{7} + 2\frac{3}{7} - 5\frac{4}{7}$? $8 - 3\frac{2}{9} + 6\frac{5}{9}$? $17 - 9\frac{8}{11} - 3\frac{3}{11}$? $13 - 2\frac{5}{6} - \frac{5}{6}$? $4\frac{7}{8} + 3\frac{5}{8} - 2\frac{3}{8}$? $4 + 3\frac{3}{7} + 2\frac{6}{7} + \frac{5}{7}$? $7 - 3\frac{1}{4} - 2\frac{3}{4} + 4\frac{1}{4} - 3\frac{3}{4}$? $8 - 1\frac{5}{6} + 5\frac{5}{6}$? $16\frac{3}{13} - 2\frac{8}{13} - 6\frac{12}{13}$? $6\frac{7}{15} - 3\frac{2}{15} - 2\frac{2}{15} + 8\frac{7}{15}$? $6 - \frac{2}{3} + 5\frac{2}{3} - 8\frac{1}{3}$?

G. 1. Jane bought a dictionary for $\frac{3}{4}$ of a dollar, and a spelling-book for $\frac{1}{4}$ of a dollar; how much did *she give for* both?

Solution. She gave $\frac{3}{4}$ of a dollar for the dictionary, and $\frac{1}{4}$ of a dollar for the spelling-book, which are $\frac{4}{4}$ of a dollar, equal to 1 dollar; therefore, she gave 1 dollar for both.

2. Freeman picked $\frac{4}{7}$ of a bushel of cranberries on Monday, and $\frac{3}{7}$ of a bushel on Tuesday; how many bushels did he pick in both days? If he sell $\frac{5}{7}$ of a bushel of the cranberries, how many sevenths of a bushel will he have left?

3. Helen had a large orange, but she has given $\frac{3}{5}$ of it away; how much of it has she left?

Solution. One orange is equal to $\frac{5}{5}$ of an orange; therefore, if she had a whole orange, and has since given away $\frac{3}{5}$ of it, she must have $\frac{2}{5}$ of it left; because $\frac{3}{5}$ from $\frac{5}{5}$ leave $\frac{2}{5}$.

4. Charles has picked $\frac{3}{8}$ of a quart of blueberries, William $\frac{1}{8}$, and Alfred $\frac{3}{8}$; how many has William picked more than Charles? than Alfred? How many more must Charles get to have a quart? must William? must Alfred?

5. A farmer sold $\frac{1}{2}$ bushel of greenings for $\frac{3}{4}$ of a dollar, and $\frac{1}{2}$ bushel of Baldwins for $\frac{1}{4}$ of a dollar; how many apples did he sell? How much did he get for them?

6. A lady bought some cotton cloth for $\frac{3}{10}$ of a dollar, some linen for $\frac{2}{10}$ of a dollar, and some silk for $\frac{5}{10}$ of a dollar; how much did all cost? If she has 1 dollar in her purse, how much will she have left after paying for the articles she has bought?

7. Mr. Davis owns $\frac{5}{17}$ of a vessel, Mr. Pratt $\frac{8}{17}$ and Mr. Lowe owns the rest; how much does Mr. Lowe own? If Mr. Pratt should sell $\frac{2}{17}$ of the vessel to Mr. Lowe, how many seventeenths would he have left? How many would Mr. Lowe then have?

8. Hannah, Lydia, and Myra gave some money to a charitable society; Hannah gave $\frac{5}{16}$ of a dollar,

Lydia gave $\frac{6}{16}$, and Myra gave enough to make up a dollar; how much did Myra give?

9. A man bought $\frac{7}{20}$ of a ton of hay of one man, and $\frac{13}{20}$ of another; how much did he buy of both? How much will he have after his cattle have eaten $\frac{1}{2}$ of a ton?

10. Mr. Eaton had $\frac{3}{8}$ of a barrel of apples, and he bought $\frac{1}{8}$ of a barrel more; how many barrels of apples had he then? He sold $\frac{3}{20}$ of a barrel of them, gave away $\frac{6}{20}$, and kept the rest for his own use; how many did he keep for his own use?

11. A man in going from Boston to Providence, rode $\frac{7}{13}$ of the distance, and walked the rest; what part of it did he walk? In returning, he rode $\frac{3}{10}$ of the distance, and walked the rest; what part of the distance did he walk in returning?

12. A pedlar sold $\frac{4}{8}$ of a yard of cotton cloth for $\frac{1}{16}$ of a dollar, and $\frac{7}{8}$ of a yard of woollen cloth for $\frac{12}{16}$ of a dollar; how many yards of cloth did he sell? How much did he receive for it?

13. If a history can be bought for $\frac{7}{8}$ of a dollar, a reader for $\frac{4}{8}$ of a dollar, a grammar for $\frac{3}{8}$ of a dollar, and a geography for $\frac{5}{8}$ of a dollar, for how much can they all be bought? How much more money must a person who has 2 dollars get to buy them all?

14. In one lot of land there are 3 acres, in another $\frac{7}{8}$ of an acre, and in another $\frac{3}{8}$ of an acre; how many acres are there in the three lots? How many more in all than in the three acre lot?

15. Louisa has 6 apples, and Maria has $5\frac{3}{4}$ apples; if they put them together in a basket, how many will there be in the basket? If Maria should take out 3 of the apples, and Louisa should take out 2 of them, how many would be left in the basket?

16. Mr. Bryant has sold $3\frac{1}{8}$ bushels of apples to

one man, $\frac{1}{8}$ of a bushel to another, 4 bushels to another, and has $8\frac{1}{8}$ bushels left; how many bushels had he at first? How many more than he has left? How many more has he left than he sold?

17. Mr. Blake owed William $\frac{7}{16}$ of a dollar for doing errands, and $\frac{1}{4}\frac{1}{6}$ for work, but through mistake he paid him $1\frac{3}{16}$ dollars; how much ought William to give him back?

18. A man bought a barrel of flour for $6\frac{3}{8}$ dollars, two bags of corn for $2\frac{7}{8}$ dollars, a quantity of oats for $3\frac{1}{8}$ dollars, and some barley for $4\frac{3}{8}$ dollars; how much did all cost?

19. Everett asked his sister if she could tell him how much $4\frac{1}{8}$ plus $3\frac{3}{8}$ plus 2 plus $7\frac{1}{8}$ equals. She answered 19. Was she right? What should have been her answer? How much did her answer differ from the true one?

20. An errand boy had in his basket $3\frac{2}{8}$ pounds of sugar, $1\frac{3}{8}$ pounds of tea, $5\frac{4}{8}$ pounds of coffee, $\frac{7}{8}$ of a pound of chocolate, and $4\frac{1}{8}$ pounds of starch; how many pounds weight had he in his basket? He left the tea and coffee at a boarding house; how many pounds remained in his basket?

21. In one lot of land there are $3\frac{5}{8}$ acres, in another $\frac{7}{8}$ of an acre, and in another $6\frac{3}{8}$ acres; how many acres are there in the three lots? How many more acres in all than in the $3\frac{5}{8}$ acre lot?

22. Mr. Clapp hired 3 laborers to work in his garden; the first received $1\frac{3}{8}$ dollars per day, the second $1\frac{7}{8}$ dollars per day, and the third received as much as both the others; how much did the third receive? How much did all receive?

23. A teamster, in loading his wagon with grain, put in $8\frac{3}{4}$ bushels of corn, $7\frac{3}{4}$ bushels of oats, and $2\frac{1}{4}$ bushels of wheat; how many bushels of grain did he put into the wagon? He unloaded the corn at a

stable, and the rest of the grain at a grain store; how much did he unload at the grain store?

24. A man paid 11⅞ dollars for a coat, 3⅞ dollars for a pair of pants, 2⅝ dollars for a vest, and 1⅞ dollars for a cravat; how many dollars did the whole suit of clothes cost? If he gave a twenty-dollar bill to pay for them, how much change ought he to receive in return?

SECTION XVI.

A. 1. 4 times ½? 4 times ¼? 4 times ⅛?
2. 4 times $\frac{1}{12}$? 3 times ⅔? 3 times ⅜?
3. 5 times ⅘? 5 times ⅖? 5 times $\frac{3}{10}$?
4. 8 times ⅜? 7 times ⅛? 9 times ¼?
5. 6 times $\frac{3}{11}$? 5 times ⅕? 8 times $\frac{2}{15}$?
6. 9 times $\frac{2}{10}$? 7 times ¼? 8 times ⅝?
7. 4 times ⅘? 3 times ⅝? 2 times ¾?

B. 1. 4 times 3⅘? *Solution.* Four times three are twelve, and four times four fifths are sixteen fifths, equal to three and one fifth, which, added to twelve, makes fifteen and one fifth; therefore 4 times 3⅘ are 15⅕.
2. 5 times 2¾? 6 times 2⅝? 7 times $2\frac{3}{10}$?
3. 9 times 2⅔? 2 times 3¼? 2 times 4⅝?
4. 2 times $7\frac{10}{11}$? 2 times 8⅜? 12 times 1½?
5. 15 times $1\frac{1}{16}$? 4 times 4½? 6 times 2⅞?
6. 3 times 5⅝? 5 times 3⅜? 6 times 3⅛?
7. 18 times $1\frac{1}{18}$? 7 times 1⅛? 9 times 1⅐?
8. 9 times 1½? 3 times 3⅘? 4 times 2⅜?

C. 1. How many times ⅜ are there in ¾? 7 in $\frac{5}{11}$?

2. $\frac{2}{3}$ in $\frac{8}{9}$? $\frac{2}{20}$ in $\frac{6}{20}$? $\frac{2}{5}$ in $\frac{8}{5}$? $\frac{4}{9}$ in $\frac{8}{9}$?
3. $\frac{4}{11}$ in $\frac{8}{11}$? $\frac{4}{15}$ in $\frac{8}{15}$? $\frac{2}{5}$ in $\frac{4}{5}$? $\frac{2}{9}$ in $\frac{4}{9}$?
4. $\frac{2}{3}$ in $\frac{4}{3}$? $\frac{2}{11}$ in $\frac{4}{11}$? $\frac{2}{15}$ in $\frac{4}{15}$? $\frac{6}{13}$ in $1\frac{2}{13}$?
5. $\frac{8}{10}$ in $\frac{9}{10}$? $\frac{3}{13}$ in $\frac{12}{13}$? $\frac{7}{15}$ in $\frac{14}{15}$? $\frac{8}{9}$ in $1\frac{6}{9}$?
6. $\frac{2}{19}$ in $\frac{20}{19}$? $\frac{5}{18}$ in $\frac{15}{18}$? $\frac{3}{13}$ in $\frac{6}{13}$?

D. 1. How many times $\frac{2}{3}$ are there in $3\frac{1}{3}$?

Solution. Three and one third is equal to ten thirds; and two thirds are contained in ten thirds, five times; therefore $\frac{2}{3}$ are contained in $3\frac{1}{3}$, 5 times.

2. How many times $\frac{4}{5}$ are there in $3\frac{1}{5}$? $\frac{7}{8}$ in $1\frac{6}{8}$?
3. $\frac{3}{5}$ in $2\frac{2}{5}$? $\frac{5}{7}$ in $2\frac{6}{7}$? $\frac{3}{4}$ in $2\frac{1}{4}$? $\frac{6}{7}$ in $2\frac{4}{7}$?
4. $\frac{2}{3}$ in 4? $\frac{1}{4}$ in $4\frac{3}{4}$? $\frac{5}{6}$ in $2\frac{3}{6}$? $\frac{3}{8}$ in $1\frac{1}{8}$?
5. $\frac{4}{9}$ in $2\frac{2}{9}$? $\frac{8}{11}$ in $1\frac{7}{11}$? $\frac{2}{3}$ in $1\frac{7}{9}$? $\frac{3}{8}$ in 2?

E. 1. How many times $1\frac{1}{3}$ are there in $5\frac{1}{3}$?

Direction. Reduce both to thirds.

2. How many times $2\frac{1}{2}$ are there in $7\frac{1}{2}$?
3. $1\frac{2}{3}$ in $6\frac{2}{3}$? $1\frac{4}{5}$ in $3\frac{2}{5}$? $1\frac{3}{8}$ in $3\frac{7}{8}$? $2\frac{2}{3}$ in $5\frac{1}{3}$?
4. $1\frac{2}{4}$ in 3? $1\frac{2}{3}$ in 5? $1\frac{2}{3}$ in $3\frac{1}{3}$? $\frac{6}{7}$ in $2\frac{4}{7}$?
5. $1\frac{1}{2}$ in 6? $1\frac{1}{3}$ in $3\frac{1}{3}$? $1\frac{4}{5}$ in $3\frac{3}{5}$? $1\frac{1}{4}$ in $2\frac{2}{4}$?
6. $1\frac{1}{4}$ in $3\frac{3}{4}$? $1\frac{2}{7}$ in $2\frac{4}{7}$? $1\frac{2}{5}$ in $2\frac{1}{5}$? $3\frac{1}{3}$ in $6\frac{2}{3}$?

F. 1. $4\frac{1}{2}$ multiplied by 3, less 6, divided by $1\frac{1}{2}$?
2. $3\frac{4}{7}$ multiplied by 5, less $1\frac{6}{7}$, divided by 4, plus $7\frac{1}{2}$?
3. 5 divided by $\frac{1}{2}$, less $2\frac{1}{2}$, divided by $2\frac{1}{2}$?
4. $4\frac{2}{3}$ divided by $2\frac{1}{3}$, multiplied by 6, less $8\frac{1}{3}$?
5. $17\frac{3}{4}$, less $2\frac{1}{4}$, less $7\frac{3}{4}$, multiplied by 2?
6. $2\frac{3}{8}$ multiplied by 5, plus $3\frac{3}{8}$, less $14\frac{4}{8}$, divided by $\frac{3}{8}$?

G. 1. Bought 6 bushels of potatoes at $\frac{3}{4}$ of a *dollar per bushel*, and 7 bushels of rye at $1\frac{1}{4}$ dollars *per bushel*; what was the cost of the potatoes? of *the rye?* of both? How much more did the rye *cost than* the potatoes?

2. Timothy worked 2 hours at $\frac{3}{5}$ of a dime per hour, and 3 hours at $\frac{4}{5}$ of a dime per hour; how many dimes did he earn?

3. A shoe dealer bought 5 pounds of sole leather at $1\frac{1}{2}$ shillings per pound, and 2 pounds of calf skin at $5\frac{1}{2}$ shillings per pound; what did both articles cost?

4. I bought 3 table spoons at $2\frac{1}{5}$ dollars each, and 2 dozens of tea spoons at $5\frac{3}{5}$ dollars per dozen; what must I pay for both lots of spoons?

5. A man bought 5 volumes of Roman History at $2\frac{3}{8}$ dollars per volume, and 4 volumes of Grecian History, at $1\frac{5}{8}$ dollars, per volume; how much did they all cost?

6. Mr. Sumner walked 4 hours at the rate of $3\frac{1}{7}$ miles per hour, and 1 hour at the rate of $4\frac{3}{7}$ miles per hour; how far did he walk in all?

7. A trader sold 6 pounds of black tea at $\frac{3}{7}$ of a dollar per pound, 3 pounds of green tea at $\frac{5}{7}$ of a dollar per pound, and 2 pounds of very nice tea at $1\frac{1}{7}$ dollars per pound; for how much did he sell the whole?

8. How many pounds of black tea at $\frac{2}{9}$ of a dollar per pound can be bought for $\frac{8}{9}$ of a dollar?

9. A farmer bought 2 pecks of seed barley at $\frac{3}{8}$ of a dollar per peck; how much did it cost? He paid for it with eggs at $\frac{2}{8}$ of a dollar per dozen; how many dozens did it take?

10. Samuel can earn $1\frac{2}{3}$ dollars per day, but William can earn only $\frac{2}{3}$ of a dollar per day; how much can Samuel earn in 4 days? In how many days can William earn as much as Samuel can earn in 4 days?

11. A pedlar sold 3 yards of linen at $\frac{5}{6}$ of a dollar per yard; how much did he get for it? With the money he received for it, he bought some calico

at $\frac{3}{16}$ of a dollar per yard; how many yards of calico did he buy?

12. A boy who had a large apple gave away $\frac{5}{17}$ of it, and divided the rest among his companions, giving to each $\frac{3}{17}$; to how many did he give it?

13. If the upper leather for a pair of shoes costs $\frac{2}{5}$ of a dollar, the sole leather $\frac{1}{4}$ of a dollar, and the making $\frac{2}{5}$ of a dollar, what will be the whole cost of 1 pair? of 2 pairs? of 4 pairs?

14. What cost 2 umbrellas at $2\frac{7}{8}$ dollars apiece? How much silk, at $1\frac{1}{2}$ dollars per yard, will be required to pay for the umbrellas?

15. How many dozen razor straps, at $\frac{8}{9}$ of a dollar per dozen, can be bought for 8 pounds of butter, at $\frac{2}{9}$ of a dollar per pound?

16. A shoemaker has contracted a debt of $2\frac{1}{4}$ dollars, which he wishes to discharge by making boots, at $\frac{9}{4}$ of a dollar per pair; how many pairs of boots must he make?

17. If 5 men can do a piece of work in $3\frac{1}{2}$ days, in how many days would one man do it? How much longer would it take 1 man than 5 to do it?

18. Mr. Ward purchased 6 chairs at $\frac{3}{4}$ of a dollar apiece, and 2 tables at $7\frac{3}{4}$ dollars apiece; how much did he pay for the chairs? for the tables? for both chairs and tables? How much more for the tables than for the chairs? Having paid but 10 dollars, he gave his note for the rest; for how much is the note given?

19. I have $19\frac{1}{4}$ yards of sheeting, from which I wish to make 3 sheets, each containing $5\frac{1}{4}$ yards; how many yards will be required? How many yards will remain? How many curtains, each containing $1\frac{3}{4}$ yards, can be made from what remains?

20. What is the amount of a female's wages for 3 weeks, at $2\frac{1}{2}$ dollars per week? For how many

weeks will the sum pay her board, at $1\frac{1}{2}$ dollars per week?

21. A white man and an Indian are to run a race; the white man runs at the rate of a mile in $6\frac{3}{8}$ minutes, and the Indian at the rate of a mile in $5\frac{1}{8}$ minutes; how long time will be required for the white man to run 3 miles? for the Indian? In how much less time will the Indian run 3 miles than the white man?

22. A train of cars was run $\frac{8}{9}$ of a mile at the rate of $\frac{2}{3}$ of a mile per minute, $\frac{8}{9}$ of a mile at the rate of $\frac{3}{4}$ of a mile per minute, $\frac{4}{7}$ of a mile at the rate of $\frac{2}{3}$ of a mile per minute, and $\frac{3}{4}$ of a mile at the rate of $\frac{1}{2}$ of a mile per minute; how far did they run? how long were they in running the whole distance?

23. Mr. Page employed a tailor to make him a suit of clothes; for making the coat the tailor charged $6\frac{3}{8}$ dollars, for making the pants $1\frac{7}{8}$ dollars, and for making the vest $1\frac{5}{8}$ dollars; how much did he charge for making the suit? Providing it took 7 yards of cloth worth $1\frac{3}{4}$ dollars per yard, how much did the cloth for the suit cost? how much did the cloth and making cost?

SECTION XVII.

A. 1. What part of 2 is 1?

Ans. One is one half of two, because if two be divided into two equal parts, one of those parts will contain one.

2. What part of 2 is 3?

Ans. Since 1 is $\frac{1}{2}$ of 2, 3, which is 3 times 1, must be 3 times $\frac{1}{2}$ of 2, which are $\frac{3}{2}$ of 2, equal to *once 2 and* $\frac{1}{2}$ of 2.

What part

3. Of 2 is 5? of 2 is 7? of 3 is 1? of 4 is 1?
4. Of 5 is 1? of 6 is 1? of 3 is 2? of 5 is 4?
5. Of 5 is 2? of 4 is 3? of 7 is 1? of 8 is 1?
6. Of 9 is 1? of 10 is 1? of 11 is 1? of 6 is 5?
7. Of 5 is 6? of 12 is 7? of 7 is 12? of 12 is 1?
8. Of 10 is 9? of 9 is 10? of 11 is 3? of 3 is 11?
9. Of 8 is 3? of 19 is 12? of 12 is 19? of 20 is 7?
10. Of 7 is 20? of 14 is 9? of 8 is 11? of 11 is 8?
11. Of 13 is 14? of 11 is 4? of 4 is 11? of 6 is 2?

Ans. $2 = \frac{2}{6}$ of 6; and $\frac{2}{6} = \frac{1}{3}$, because 3 times $\frac{2}{6}$ equals $\frac{6}{6}$, or the whole; therefore, 2 is $\frac{2}{6}$ or $\frac{1}{3}$ of 6.

12. What part of 6 is 4?

Ans. 4 is $\frac{4}{6}$ of 6; but $\frac{4}{6} = 2$ times $\frac{2}{6}$, and $\frac{2}{6} = \frac{1}{3}$; $\frac{4}{6}$, then, must equal 2 times $\frac{1}{3}$, which are $\frac{2}{3}$; therefore, 4 is $\frac{4}{6}$ or $\frac{2}{3}$ of 6.

What part

13. Of 8 is 2? of 8 is 6? of 6 is 8? of 10 is 2?
14. Of 10 is 8? of 12 is 2? of 12 is 10? of 10 is 12?
15. Of 9 is 3? of 3 is 9? of 9 is 6? of 6 is 3?
16. Of 6 is 9? of 14 is 2? of 14 is 8? of 15 is 5?
17. Of 15 is 10? of 10 is 5? of 10 is 15? of 9 is 18?
18. Of 14 is 7? of 18 is 6? of 6 is 18? of 4 is 2?
19. Of 2 is 4? of 20 is 5? of 20 is 15? of 20 is 10?
20. Of 5 is 20? of 15 is 20?

B. What part

1. Of $\frac{2}{3}$ is $\frac{1}{3}$? of $\frac{2}{7}$ is $\frac{1}{7}$? of $\frac{2}{9}$ is $\frac{1}{9}$? of $\frac{2}{5}$ is $\frac{1}{5}$?
2. Of $\frac{2}{19}$ is $\frac{1}{19}$? of $\frac{6}{7}$ is $\frac{1}{7}$? of $\frac{6}{11}$ is $\frac{1}{11}$? of $\frac{3}{4}$ is $\frac{1}{4}$?
3. Of $\frac{3}{8}$ is $\frac{1}{8}$? of $\frac{3}{10}$ is $\frac{1}{10}$? of $\frac{8}{9}$ is $\frac{1}{9}$? of $\frac{7}{11}$ is $\frac{1}{11}$?
4. Of $\frac{2}{13}$ is $\frac{1}{13}$? of $\frac{1}{12}$ is $\frac{1}{12}$? of $\frac{4}{7}$ is $\frac{1}{7}$? of $\frac{4}{7}$ is $\frac{3}{7}$?
5. Of $\frac{4}{5}$ is $\frac{3}{5}$? of $\frac{5}{8}$ is $\frac{4}{8}$? of $\frac{4}{9}$ is $\frac{5}{9}$? of $\frac{3}{5}$ is $\frac{4}{5}$?
6. Of $\frac{5}{12}$ is $\frac{2}{12}$? of $\frac{2}{12}$ is $\frac{5}{12}$? of $\frac{5}{7}$ is $\frac{2}{7}$? of $\frac{2}{3}$ is $\frac{5}{7}$?
7. Of $\frac{8}{13}$ is $\frac{3}{13}$? of $\frac{6}{7}$ is $\frac{4}{7}$? of $\frac{6}{7}$ is $\frac{4}{5}$? of $\frac{8}{9}$ is $\frac{3}{9}$?
8. Of $\frac{8}{9}$ is $\frac{6}{9}$? of $\frac{6}{9}$ is $\frac{8}{9}$? of $\frac{10}{11}$ is $\frac{2}{11}$? of $\frac{10}{11}$ is $\frac{8}{11}$?
9. Of $\frac{12}{17}$ is $\frac{2}{17}$? of $\frac{13}{17}$ is $\frac{10}{11}$? of $\frac{2}{17}$ is $\frac{13}{17}$? of $\frac{7}{10}$ is $\frac{3}{10}$?

10. Of $\frac{3}{10}$ is $\frac{7}{10}$? of $\frac{1}{19}$ is $\frac{12}{19}$? of $\frac{2}{19}$ is $\frac{12}{19}$? of $\frac{10}{19}$ is $\frac{6}{19}$?
11. Of $1\frac{2}{3}$ is $\frac{1}{3}$?

Solution. $1\frac{2}{3} = \frac{5}{3}$; and, since $\frac{1}{3}$ is $\frac{1}{5}$ of $\frac{5}{3}$, it must be $\frac{1}{5}$ of $1\frac{2}{3}$.

What part

12. Of $4\frac{1}{2}$ is $\frac{1}{2}$? of $3\frac{1}{3}$ is $\frac{1}{3}$? of $3\frac{1}{5}$ is $\frac{1}{5}$? of $3\frac{1}{5}$ is $\frac{2}{5}$?
13. Of $\frac{2}{5}$ is $3\frac{1}{5}$? of $4\frac{1}{4}$ is $\frac{3}{4}$? of $\frac{3}{4}$ is $4\frac{1}{4}$? of $1\frac{5}{8}$ is $\frac{7}{8}$?
14. Of $\frac{1}{8}$ is $1\frac{5}{8}$? of $2\frac{3}{7}$ is $\frac{4}{7}$? of $2\frac{2}{9}$ is $\frac{4}{9}$? of $\frac{4}{5}$ is $2\frac{2}{5}$?
15. Of $2\frac{1}{7}$ is $\frac{3}{7}$? of $1\frac{7}{9}$ is $\frac{8}{9}$? of $3\frac{1}{4}$ is $\frac{3}{4}$? of $2\frac{1}{4}$ is $\frac{4}{7}$?
16. Of $\frac{4}{7}$ is $2\frac{1}{7}$? of $2\frac{5}{6}$ is $\frac{5}{6}$? of $\frac{5}{6}$ is $2\frac{5}{6}$? of $1\frac{4}{5}$ is $\frac{3}{5}$?
17. Of $2\frac{1}{3}$ is $1\frac{2}{3}$? of $1\frac{2}{3}$ is $2\frac{1}{3}$? of $3\frac{1}{5}$ is $1\frac{2}{5}$?
18. Of $1\frac{2}{5}$ is $3\frac{1}{5}$? of $7\frac{1}{2}$ is $2\frac{1}{2}$? of $3\frac{2}{5}$ is $2\frac{1}{5}$?
19. Of $2\frac{1}{5}$ is $3\frac{2}{5}$? of $1\frac{1}{2}$ is 1? of $2\frac{1}{4}$ is 2?
20. Of 2 is $2\frac{2}{7}$? of 6 is $1\frac{1}{2}$? of $1\frac{1}{2}$ is 6? of $5\frac{1}{3}$ is $2\frac{2}{3}$?
21. Of $2\frac{2}{5}$ is $5\frac{1}{3}$? of 4 is $\frac{1}{2}$? of $9\frac{1}{3}$ is 2? of 6 is $3\frac{1}{3}$?
22. Of $3\frac{1}{3}$ is 6? of $4\frac{1}{2}$ is $7\frac{1}{2}$? of $7\frac{1}{2}$ is $4\frac{1}{2}$?
23. Of $3\frac{2}{5}$ is 3? of 3 is $3\frac{2}{5}$? of $2\frac{1}{3}$ is $1\frac{1}{3}$?
24. Of $6\frac{2}{3}$ is $1\frac{2}{3}$? of $1\frac{2}{3}$ is $6\frac{2}{3}$?

C. 1. What part of 1 gallon and 3 quarts is 1 quart?

Solution. 1 gallon equals 4 quarts, and 3 quarts added make 7 quarts; 1 quart is $\frac{1}{7}$ of 7 quarts; therefore, 1 quart is $\frac{1}{7}$ of 1 gallon and 3 quarts.

2. What part of 1 gallon and 3 quarts is 3 quarts? is 1 gallon? is 1 gallon and 1 quart? is 1 gallon and 2 quarts?

3. What part of 2 gallons and 1 quart is 1 quart? is 1 gallon? is 1 gallon and 2 quarts? is 2 gallons?

4. What part of 3 gallons is 1 quart? is 2 gallons and 1 quart? of 4 gallons and 1 quart is 3 gallons and 1 quart? of 3 gallons and 2 quarts is 2 gallons and 3 quarts? of 5 gallons is 1 gallon and 1 quart?

5. *If* 8 furlongs make a mile, what part of a mile

is 1 furlong? of 1 mile is 3 furlongs? of 1 mile and 6 furlongs is 5 furlongs? of 2 miles and 3 furlongs is 2 miles? of 2 miles is 1 mile and 7 furlongs.

6. What part of the cost of 7 yards of cloth is the cost of 3 yards?

7. What part of the cost of 3 gallons and 1 quart of oil is the cost of 1 quart? of 3 quarts? of 1 gallon? of 1 gallon and 3 quarts? of 2 gallons? of 3 gallons?

8. When flour is worth 6 dollars per barrel, what part of a barrel can be bought for 1 dollar? for $1\frac{1}{2}$ dollars? for $2\frac{2}{3}$ dollars? for $5\frac{1}{3}$ dollars? for $4\frac{1}{2}$ dollars?

9. Mr. Keith bought 5 gallons of oil for Mr. Harlow, and 3 gallons for Mr. Weeden; how many gallons did he buy for both? What part of the cost of the whole ought Mr. Harlow to pay? ought Mr. Weeden?

10. Mr. Cushman, Mr. Leach, and Mr. Revere, together, bought 17 bushels of corn, which they so divided that Mr. Cushman had 7 bushels, Mr. Leach 4 bushels, and Mr. Revere 6 bushels; what part of the cost of the whole ought each one to pay?

11. Three men hired a pasture together, in which the first man pastured 2 cows, the second 3, and the third 4; what part of the whole rent ought each man to pay?

12. Sold for Mr. Boyden 3 bags of grain, each bag containing 2 bushels, and for Mr. Brown 2 bags, each containing 4 bushels; what part of the money received for the whole ought I to pay to Mr. Boyden? to Mr. Brown?

13. Mr. Thayer, Mr. Rogers, and Mr. Wilder *bought a piece of* cloth for $6\frac{3}{4}$ dollars; of which Mr. *Thayer paid* $1\frac{3}{4}$ dollars, Mr. Rogers, $2\frac{1}{2}$ dollars, and

Mr. Wilder $2\frac{2}{3}$ dollars; what part of the whole cost did Mr. Thayer pay? did Mr. Rogers? did Mr. Wilder? What part of the cloth should each have?

14. Harry, John and Richard gave some money to a poor woman; Harry gave her 7 cents, John gave her 5, and Richard gave her 7; how many did all give her? What part of what all gave did Harry give? did John? did Richard?

SECTION XVIII.

A. 1. 1 is $\frac{1}{2}$ of what number?

Solution. 1 is $\frac{1}{2}$ of 2 times 1, and 2 times 1 are 2; therefore, 1 is $\frac{1}{2}$ of 2.

2. 1 is $\frac{1}{3}$ of what number?
3. 2 is $\frac{1}{2}$ of what number?
4. 7 is $\frac{1}{2}$ of what number?
5. 4 is $\frac{1}{5}$ of what number?
6. 1 is $\frac{1}{13}$ of what number?
7. 2 is $\frac{1}{8}$ of what number?
8. 9 is $\frac{1}{2}$ of what number?
9. 3 is $\frac{1}{6}$ of what number?
10. 5 is $\frac{1}{3}$ of what number?
11. 2 is $\frac{1}{10}$ of what number?
12. 6 is $\frac{1}{3}$ of what number?

B. 1. $\frac{1}{7}$ is $\frac{1}{2}$ of what number?
2. $\frac{4}{13}$ is $\frac{1}{3}$ of what number?
3. $\frac{1}{8}$ is $\frac{1}{4}$ of what number?
4. $\frac{3}{10}$ is $\frac{1}{3}$ of what number
5. $\frac{3}{17}$ is $\frac{1}{5}$ of what number
6. $\frac{6}{19}$ is $\frac{1}{2}$ of what number?
7. $\frac{2}{15}$ is $\frac{1}{7}$ of what number
8. $\frac{2}{7}$ is $\frac{1}{7}$ of what number?

9. $\frac{3}{5}$ is $\frac{1}{5}$ of what number?
10. $\frac{2}{4}$ is $\frac{1}{4}$ of what number?
11. $\frac{2}{3}$ is $\frac{1}{4}$ of what number?
12. $\frac{3}{5}$ is $\frac{1}{5}$ of what number?
13. $\frac{4}{5}$ is $\frac{1}{8}$ of what number?
14. $\frac{3}{6}$ is $\frac{1}{6}$ of what number?
15. $\frac{4}{5}$ is $\frac{1}{5}$ of what number?
16. $\frac{2}{16}$ is $\frac{1}{8}$ of what number?
17. $\frac{2}{5}$ is $\frac{1}{5}$ of what number?
18. $\frac{2}{8}$ is $\frac{1}{8}$ of what number?
19. $\frac{4}{7}$ is $\frac{1}{8}$ of what number?

C. 1. $2\frac{1}{2}$ is $\frac{1}{2}$ of what number?
2. $3\frac{5}{7}$ is $\frac{1}{3}$ of what number?
3. $6\frac{1}{2}$ is $\frac{1}{2}$ of what number?
4. $2\frac{1}{6}$ is $\frac{1}{6}$ of what number?
5. $2\frac{3}{4}$ is $\frac{1}{4}$ of what number?
6. $6\frac{1}{3}$ is $\frac{1}{3}$ of what number?
7. $4\frac{2}{8}$ is $\frac{1}{4}$ of what number?
8. $3\frac{3}{5}$ is $\frac{1}{4}$ of what number?
9. $1\frac{7}{8}$ is $\frac{1}{2}$ of what number?
10. $2\frac{2}{6}$ is $\frac{1}{6}$ of what number?
11. $1\frac{1}{4}$ is $\frac{1}{8}$ of what number?
12. $8\frac{1}{3}$ is $\frac{1}{2}$ of what number?
13. $3\frac{3}{4}$ is $\frac{1}{5}$ of what number?
14. $2\frac{2}{4}$ is $\frac{1}{4}$ of what number?
15. $3\frac{1}{5}$ is $\frac{1}{5}$ of what number?
16. $6\frac{3}{4}$ is $\frac{1}{3}$ of what number?
17. $1\frac{1}{6}$ is $\frac{1}{12}$ of what number?
18. $1\frac{1}{9}$ is $\frac{1}{18}$ of what number?
19. $4\frac{2}{4}$ is $\frac{1}{3}$ of what number?
20. $5\frac{2}{3}$ is $\frac{1}{3}$ of what number?

D. 1. William has 3 cents, which he fin
just $\frac{1}{3}$ as many as Francis has; how many
Francis?

2. A man started from his home to go to Bo

he travelled 4 miles, and then found that he had travelled $\frac{1}{5}$ of the whole distance; how far was his home from Boston?

3. Mr. Barnard owes a man some money, and he finds that by paying 5 dollars, he shall pay $\frac{1}{8}$ of the debt; what is the debt? After he has paid 5 dollars, how many thirds of the debt will he owe? how many dollars?

4. Arthur had some apples in a basket; he gave away $\frac{1}{2}$ of them, and then had 8 apples left; how many apples had he at first?

5. Freeman rode $\frac{3}{5}$ of the way from Dedham to Canton, and found that he had 2 miles further to go; how many miles is it from Dedham to Canton?

6. Ruth's brother gave her some black silk; she used $\frac{3}{4}$ of it for a dress, and had 3 yards left; how many yards did her brother give her? How many yards did she use for the dress?

7. Seth had some money, $\frac{3}{8}$ of which he spent for peaches, $\frac{1}{8}$ for pears, and the remainder, which was 2 cents, for apples; how much money had he at first? How much did he spend for peaches? for pears?

8. Solon gave 3 of his companions 2 marbles apiece; after which he had $\frac{2}{3}$ as many left as he had at first; how many had he left? How many had he at first?

9. A man gave some books to 3 girls; to the first he gave $\frac{1}{2}$ of them, to the second he gave $\frac{1}{4}$ of them, and to the third he gave the remainder, 2 books; how many did he give to all? How many did he give to each of the girls?

10. A man, on being asked how much land he owned, replied, "My garden contains $\frac{3}{10}$ of my land, my pasture $\frac{4}{10}$, my orchard $\frac{2}{10}$, and my house-lot of

2 acres contains the rest; how many acres of land did the man own? How much had he in each lot?

11. Theodore gave his brother $3\frac{1}{2}$ sheets of paper, which was $\frac{1}{5}$ of all he had; how many sheets had he?

12. Erastus had some chestnuts, of which he gave $\frac{1}{6}$ to Edwin, $\frac{2}{6}$ to Theron, $\frac{1}{6}$ to Horace, and the remainder, $\frac{2}{6}$ of a quart, he kept himself; how many chestnuts did he give to Edwin? to Theron? to Horace? How many had he at first?

13. Henrietta had a part of a cake, and she gave $\frac{3}{7}$ of the part which she had to Anna, $\frac{2}{7}$ to Martha, $\frac{1}{7}$ to Maria, and the rest, which was $\frac{1}{8}$ of the whole cake, to Narcissa; what part of the whole cake did she at first have? What part of the whole did she give to each of her companions?

SECTION XIX.

A. 1. What is $\frac{1}{3}$ of 6?

Ans. $\frac{1}{3}$ of 6 is 2; because 3 times 2 are 6.

2. What is $\frac{1}{2}$ of 4? $\frac{1}{3}$ of 9? $\frac{1}{7}$ of 14? $\frac{1}{4}$ of 16?
3. $\frac{1}{6}$ of 18? $\frac{1}{5}$ of 15? $\frac{1}{8}$ of 16? $\frac{1}{5}$ of 20? $\frac{1}{6}$ of 12?
4. $\frac{1}{3}$ of 12? $\frac{1}{4}$ of 20? $\frac{1}{2}$ of 14? $\frac{1}{2}$ of 1? $\frac{1}{2}$ of 2?
5. $\frac{1}{4}$ of 1? $\frac{1}{4}$ of 3? $\frac{1}{5}$ of 4? $\frac{1}{7}$ of 3? $\frac{1}{8}$ of 2?
6. $\frac{1}{8}$ of 7? $\frac{1}{11}$ of 10? $\frac{1}{8}$ of 5? $\frac{1}{5}$ of 3? $\frac{1}{7}$ of 6?

B. 1. What is $\frac{1}{2}$ of 5?

Solution. 5 is equal to 4 and 1; $\frac{1}{2}$ of 4 is 2, and $\frac{1}{2}$ of 1 is $\frac{1}{2}$, which added to 2 equals $2\frac{1}{2}$; therefore $\frac{1}{2}$ of 5 is $2\frac{1}{2}$.

2. What is $\frac{1}{3}$ of 7? $\frac{1}{2}$ of 3? $\frac{1}{5}$ of 9? $\frac{1}{7}$ of 16?
3. $\frac{1}{8}$ of 20? $\frac{1}{4}$ of 11? $\frac{1}{8}$ of 19? $\frac{1}{3}$ of 13?
4. $\frac{1}{10}$ of 17? $\frac{1}{12}$ of 20? $\frac{1}{8}$ of 15? $\frac{1}{4}$ of 9?
5. $\frac{1}{6}$ of 16? $\frac{1}{9}$ of 14? $\frac{1}{8}$ of 20? $\frac{1}{2}$ of 11?
6. $\frac{1}{8}$ of 13? $\frac{1}{7}$ of 12? $\frac{1}{3}$ of 11? $\frac{1}{6}$ of 16?

C. 1. What is $\frac{2}{3}$ of 8?

Solution. $\frac{1}{3}$ of 8 is $2\frac{2}{3}$, and $\frac{2}{3}$ of 8 must be 2 times $2\frac{2}{3}$; 2 times 2 are 4, and 2 times $\frac{2}{3}$ are $\frac{4}{3}$, equal to $1\frac{1}{3}$, which added to 4 are $5\frac{1}{3}$; therefore, $\frac{2}{3}$ of 8 is $5\frac{1}{3}$.

2. What is $\frac{3}{4}$ of 16? $\frac{2}{3}$ of 17? $\frac{5}{3}$ of 8? $\frac{2}{5}$ of 12?
3. $\frac{2}{4}$ of 9? $\frac{2}{3}$ of 15? $\frac{3}{4}$ of 20? $\frac{5}{6}$ of 19? $\frac{5}{9}$ of 9?
4. $\frac{3}{5}$ of 10? $\frac{5}{8}$ of 20? $\frac{5}{12}$ of 15? $\frac{6}{7}$ of 10?
5. $\frac{7}{3}$ of 8? $\frac{3}{8}$ of 19? $\frac{4}{11}$ of 13? $\frac{4}{5}$ of 14?
6. $\frac{3}{8}$ of 14? $\frac{2}{3}$ of 15? $\frac{2}{8}$ of 11?

D. 1. What is $2\frac{1}{4}$ times 8?

Solution. 2 times 8 are 16, and $\frac{1}{4}$ of 8 is 2, which added to 16 equals 18; therefore, $2\frac{1}{4}$ times 8 equal 18.

2. What is $3\frac{1}{3}$ times 6? $1\frac{1}{3}$ times 11?
3. $4\frac{1}{2}$ times 4? $1\frac{1}{7}$ times 10? $3\frac{1}{2}$ times 5?
4. $2\frac{1}{5}$ times 5? $3\frac{1}{7}$ times 5? $2\frac{1}{4}$ times 5?
5. $3\frac{3}{4}$ times 5? $1\frac{2}{7}$ times 10? $2\frac{2}{3}$ times 6?
6. $2\frac{5}{8}$ times 7? $2\frac{3}{8}$ times 8? $1\frac{3}{8}$ times 12?
7. $3\frac{2}{5}$ times 8? $1\frac{3}{5}$ times 12? $2\frac{2}{3}$ times 7?
8. $2\frac{3}{4}$ times 6? $4\frac{2}{3}$ times 4? $2\frac{3}{4}$ times 5?
9. $1\frac{3}{6}$ times 11? $3\frac{3}{5}$ times 5?

E. 1. What is $\frac{1}{3}$ of $\frac{5}{7}$? $\frac{1}{2}$ of $\frac{3}{5}$? $\frac{1}{3}$ of $\frac{12}{17}$? $\frac{1}{4}$ of $\frac{3}{5}$?
2. $\frac{1}{7}$ of $\frac{14}{15}$? $\frac{1}{8}$ of $\frac{16}{19}$? $\frac{1}{2}$ of $\frac{16}{17}$? $\frac{1}{6}$ of $\frac{12}{13}$? $\frac{1}{5}$ of $\frac{15}{16}$?
3. $\frac{1}{5}$ of $\frac{20}{3}$? $\frac{1}{3}$ of $\frac{18}{5}$? $\frac{1}{3}$ of $\frac{15}{2}$? $\frac{1}{6}$ of $\frac{18}{4}$? $\frac{1}{4}$ of $\frac{16}{3}$?
4. $\frac{1}{7}$ of $\frac{14}{5}$?
5. What is $2\frac{1}{4}$ times $\frac{3}{5}$? $3\frac{1}{3}$ times $\frac{5}{7}$? $5\frac{1}{2}$ times $\frac{2}{7}$?
6. $3\frac{1}{4}$ times $\frac{4}{5}$? $2\frac{1}{4}$ times $\frac{8}{11}$? $3\frac{3}{4}$ times $\frac{4}{7}$?
7. $2\frac{2}{3}$ times $\frac{6}{7}$? $1\frac{3}{5}$ times $\frac{10}{16}$? $1\frac{1}{2}$ times $\frac{8}{11}$?
8. $1\frac{5}{6}$ times $\frac{6}{15}$? $2\frac{1}{3}$ times $\frac{8}{5}$? $3\frac{1}{3}$ times $\frac{6}{11}$?
9. $3\frac{1}{5}$ times $\frac{5}{6}$? $7\frac{1}{2}$ times $\frac{2}{5}$?

F. 1. What is $\frac{1}{4}$ of $12\frac{4}{5}$?

Solution. $\frac{1}{4}$ of 12 is 3, and $\frac{1}{4}$ of $\frac{4}{5}$ is $\frac{1}{5}$, which added to 3 equals $3\frac{1}{5}$; therefore, $\frac{1}{4}$ of $12\frac{4}{5}$ equals $3\frac{1}{5}$.

2. What is $\frac{1}{3}$ of $6\frac{8}{10}$? $\frac{1}{5}$ of $15\frac{10}{11}$? $\frac{1}{8}$ of $16\frac{16}{17}$?
3. $\frac{1}{7}$ of $14\frac{7}{15}$? $\frac{1}{3}$ of $18\frac{6}{7}$? $\frac{1}{2}$ of $18\frac{10}{11}$? $\frac{2}{3}$ of $15\frac{6}{7}$?
4. $\frac{2}{5}$ of $20\frac{15}{16}$? $\frac{1}{4}$ of $20\frac{3}{5}$? $\frac{3}{4}$ of $8\frac{12}{13}$? $\frac{5}{7}$ of $7\frac{14}{15}$?
5. $\frac{3}{10}$ of $20\frac{10}{11}$? $\frac{2}{3}$ of $12\frac{9}{10}$? $\frac{4}{5}$ of $10\frac{15}{17}$?

G. 1. What is $\frac{1}{3}$ of $10\frac{2}{7}$?

Solution. $10\frac{2}{7}$ is equal to 9, a multiple of 3, and $1\frac{2}{7}$; $\frac{1}{3}$ of 9 is 3; $1\frac{2}{7}$ is equal to $\frac{9}{7}$, and $\frac{1}{3}$ of $\frac{9}{7}$ is $\frac{3}{7}$, which added to 3 makes $3\frac{3}{7}$; therefore, $\frac{1}{3}$ of $10\frac{2}{7}$ is $3\frac{3}{7}$.

2. What is $\frac{1}{2}$ of $9\frac{3}{5}$? $\frac{1}{3}$ of $7\frac{7}{8}$? $\frac{1}{4}$ of $13\frac{1}{7}$?
3. $\frac{1}{19}$ of $20\frac{1}{18}$? $\frac{1}{17}$ of $18\frac{1}{16}$? $\frac{1}{5}$ of $7\frac{1}{7}$? $\frac{1}{3}$ of $10\frac{1}{8}$?
4. $\frac{1}{11}$ of $12\frac{1}{10}$? $\frac{1}{2}$ of $11\frac{3}{7}$? $\frac{1}{9}$ of $20\frac{1}{4}$? $\frac{1}{6}$ of $7\frac{1}{5}$?
5. $\frac{1}{3}$ of $5\frac{2}{6}$? $\frac{1}{4}$ of $19\frac{1}{5}$? $\frac{1}{5}$ of $18\frac{3}{4}$? $\frac{1}{8}$ of $9\frac{1}{7}$?
6. $\frac{1}{3}$ of $16\frac{1}{5}$? $\frac{1}{6}$ of $14\frac{2}{5}$? $\frac{1}{14}$ of $15\frac{1}{13}$? $\frac{1}{4}$ of $10\frac{2}{5}$?
7. What is $\frac{2}{3}$ of $7\frac{7}{8}$? $\frac{3}{4}$ of $19\frac{1}{5}$? $\frac{2}{5}$ of $18\frac{3}{4}$?
8. $\frac{5}{17}$ of $18\frac{1}{16}$? $\frac{17}{18}$ of $19\frac{1}{17}$? $\frac{11}{12}$ of $13\frac{1}{11}$?
9. $\frac{5}{8}$ of $20\frac{1}{4}$? $\frac{5}{6}$ of $7\frac{1}{5}$? $\frac{3}{8}$ of $9\frac{1}{7}$? $\frac{3}{4}$ of $10\frac{2}{5}$?
10. $\frac{4}{5}$ of $12\frac{1}{2}$? $\frac{2}{3}$ of $16\frac{1}{5}$? $\frac{3}{2}$ of $11\frac{1}{11}$? $\frac{2}{7}$ of $18\frac{3}{3}$?
11. $\frac{4}{5}$ of $13\frac{2}{6}$? $\frac{4}{9}$ of $19\frac{5}{13}$?

H. 1. What is the cost of $\frac{3}{4}$ of a pound of starch, at 12 cents per pound?

Solution. If 1 pound of starch cost 12 cents, $\frac{3}{4}$ of a pound will cost $\frac{3}{4}$ of 12 cents; $\frac{1}{4}$ of 12 cents is 3 cents, and $\frac{3}{4}$ must be 3 times 3 cents, which are 9 cents; therefore, $\frac{3}{4}$ of a pound of starch, at 12 cents per pound, will cost 9 cents.

2. What will $\frac{5}{8}$ of a yard of cloth cost, at 18 cents per yard?

3. If a ton of hay is worth 17 dollars, what is $\frac{6}{7}$ of a ton worth?

4. At 6 cents a pound, what cost $3\frac{3}{8}$ pounds of rice?

5. *At* $\frac{8}{10}$ of a dollar per bushel, what cost $\frac{3}{5}$ of a *bushel of barley*?

6. *When* hay is worth $15\frac{1}{4}$ dollars per ton, what *is* $\frac{4}{5}$ *of a ton worth*?

7. What will be the cost of $\frac{5}{7}$ of a bushel of wheat, at $1\frac{5}{8}$ dollars per bushel?

8. At $11\frac{7}{8}$ dollars a barrel, what costs $\frac{4}{5}$ of a barrel of flour?

9. If a barrel will hold $2\frac{1}{2}$ bushels, what will a barrel of peaches cost, at 3 dollars a bushel? What will $\frac{2}{3}$ of a barrel cost?

10. If 1 pound of raisins is worth as much as 2 pounds of rice at 5 cents a pound, how many cents is $\frac{3}{4}$ of a pound of raisins worth?

Direction. First find how many *cents* 1 pound of raisins is worth.

11. Joel, Harry, and Gilbert together picked $16\frac{4}{5}$ quarts of berries, of which $\frac{3}{4}$ were picked by Joel, $\frac{3}{7}$ by Harry, and the rest by Gilbert; what part of the whole did Gilbert pick? How many quarts did each pick?

12. Lucy had 3 cents, and Julia had 5; they put their money together, and bought with it 18 apples; how many of them did Lucy's money pay for? did Julia's?

13. Mr. Fuller can build 5 rods of wall in 4 days; how many rods can he build in 9 days?

14. Mr. Sturtevant walked 18 miles in 5 hours, and Mr. Bond walked 2 hours at the same rate; how far did Mr. Bond walk?

15. Bought $\frac{3}{4}$ of a peck of blueberries, at the rate of $2\frac{1}{2}$ cents per quart; what did they cost?

16. I bought $\frac{3}{5}$ of a barrel of flour at $11\frac{7}{8}$ dollars per barrel, $\frac{2}{3}$ of a box of sugar at $13\frac{1}{2}$ dollars per box, and 2 boxes of raisins at $2\frac{1}{2}$ dollars per box; what was the cost of the whole?

17. Mr. Howard has 8 ox-yokes, which are worth $18\frac{3}{4}$ dollars; he sold 1 of them to Mr. Bradford, 5 *of them to Mr.* Cutter, and the rest to Mr. Crooker; *how much ought* each one to pay him?

18. Mr. Sumner sold $\frac{4}{5}$ of a ton of hay at dollars per ton; how much did he get for it? spent $\frac{2}{3}$ of the money he received for the hay, f sheep; how much did all the sheep cost him? I much did each sheep cost him?

SECTION XX.

A. 1. 4 is $\frac{2}{3}$ of what number?

Solution. If 4 is $\frac{2}{3}$ of some number, $\frac{1}{3}$ of the n ber must be $\frac{1}{2}$ of 4, which is 2, and $\frac{3}{3}$ or the w number must be 3 times 2, which are 6; there 4 is $\frac{2}{3}$ of 6.

2. 6 is $\frac{3}{5}$ of what number?
3. 10 is $\frac{2}{4}$ of what number?
4. 20 is $\frac{10}{8}$ of what number?
5. 9 is $\frac{3}{4}$ of what number?
6. 18 is $\frac{2}{4}$ of what number?
7. 6 is $\frac{2}{5}$ of what number?
8. 14 is $\frac{7}{8}$ of what number?
9. 11 is $\frac{2}{3}$ of what number?
10. 15 is $\frac{5}{8}$ of what number?
11. 10 is $\frac{4}{3}$ of what number?
12. 12 is $\frac{3}{4}$ of what number?
13. 15 is $\frac{4}{5}$ of what number?
14. 12 is $\frac{5}{6}$ of what number?
15. 18 is $\frac{2}{4}$ of what number?
16. 18 is $\frac{7}{7}$ of what number?
17. 9 is $\frac{2}{5}$ of what number?
18. 14 is $\frac{7}{8}$ of what number?
19. 8 is $\frac{2}{5}$ of what number?
20. 8 is $\frac{3}{7}$ of what number?

B. 1. $\frac{4}{5}$ is $\frac{2}{3}$ of what number?

Solution. If $\frac{4}{5}$ is $\frac{2}{3}$ of some number, $\frac{1}{3}$ of the number must be $\frac{1}{2}$ of $\frac{4}{5}$, which is $\frac{2}{5}$, and $\frac{3}{3}$ or the whole number must be 3 times $\frac{2}{5}$, which are $\frac{6}{5}$, equal to $1\frac{1}{5}$; therefore, $\frac{4}{5}$ is $\frac{2}{3}$ of $1\frac{1}{5}$.

2. $\frac{6}{7}$ is $\frac{3}{4}$ of what number?
3. $\frac{9}{10}$ is $\frac{3}{4}$ of what number?
4. $\frac{8}{9}$ is $\frac{2}{5}$ of what number?
5. $\frac{6}{11}$ is $\frac{2}{5}$ of what number?
6. $\frac{4}{5}$ is $\frac{2}{7}$ of what number?
7. $\frac{4}{7}$ is $\frac{2}{9}$ of what number?
8. $\frac{8}{13}$ is $\frac{2}{4}$ of what number?
9. $\frac{15}{16}$ is $\frac{5}{6}$ of what number?

C. 1. $2\frac{4}{5}$ is $\frac{2}{3}$ of what number?
2. $6\frac{3}{4}$ is $\frac{3}{5}$ of what number?
3. $10\frac{1}{2}$ is $\frac{5}{8}$ of what number?
4. $15\frac{12}{17}$ is $\frac{3}{4}$ of what number?
5. $9\frac{9}{13}$ is $\frac{3}{5}$ of what number?
6. $8\frac{4}{7}$ is $\frac{2}{3}$ of what number?
7. $12\frac{6}{11}$ is $\frac{2}{7}$ of what number?
8. $10\frac{10}{11}$ is $\frac{5}{6}$ of what number?
9. $8\frac{3}{8}$ is $\frac{4}{5}$ of what number?
10. $16\frac{16}{17}$ is $\frac{4}{3}$ of what number?

D. 1. $7\frac{1}{2}$ is $\frac{3}{4}$ of what number?
2. $5\frac{1}{4}$ is $\frac{2}{5}$ of what number?
3. $1\frac{1}{5}$ is $\frac{3}{7}$ of what number?
4. $20\frac{1}{4}$ is $\frac{3}{2}$ of what number?
5. $19\frac{1}{5}$ is $\frac{4}{3}$ of what number?
6. $11\frac{1}{4}$ is $\frac{3}{5}$ of what number?
7. $12\frac{1}{2}$ is $\frac{5}{4}$ of what number?
8. $15\frac{2}{5}$ is $\frac{7}{8}$ of what number?
9. $7\frac{1}{5}$ is $\frac{3}{4}$ of what number?

E. 1. If $\frac{2}{3}$ of a pound of candles cost 10 cents, what will a pound cost?

Solution. If $\frac{2}{3}$ of a pound of candles cost 10 cents, $\frac{1}{3}$ of a pound will cost $\frac{1}{2}$ of 10 cents, which is

5 cents, and $\frac{2}{3}$ or a pound will cost 3 times 5 cents, which are 15 cents; therefore, 1 pound of candles will cost 15 cents, if $\frac{2}{3}$ of a pound costs 10 cents.

2. If $\frac{3}{4}$ of a pound of chocolate costs 6 cents, what will a pound cost?

3. If $\frac{4}{5}$ of a pound of almonds are worth 15 cents, what is a pound worth?

4. If $\frac{14}{15}$ of a dollar will pay for $\frac{7}{8}$ of a yard of silk, what will be required to pay for a yard?

5. If $\frac{5}{7}$ of a quart of nuts cost $\frac{10}{12}$ of a dime, what cost a whole quart?

6. If the cost of $\frac{8}{9}$ of a yard of ribbon be $16\frac{16}{18}$ cents, what will be the cost of a yard?

7. When $\frac{5}{6}$ of a dollar will buy $3\frac{3}{4}$ gallons of molasses, how much will 1 dollar buy?

8. If $\frac{3}{4}$ of a dozen of pens cost $7\frac{1}{2}$ cents, what does a dozen cost?

9. Asa says he is 9 years of age, and that his age is equal to just $\frac{3}{4}$ of his sister's age; what is his sister's age?

10. James, who is 10 years of age, says that his age is equal to $\frac{5}{6}$ of his brother's age; what is his brother's age? He has a little sister, whose age is equal to $\frac{2}{3}$ of his brother's age; what is his sister's age?

11. Alfred sold $\frac{1}{4}$ of a quart of blackberries for 8 cents; what would he receive for a quart, at the same rate? If he can get as much for 1 quart of blackberries as for $1\frac{2}{5}$ quarts of blueberries, how much can he get for 1 quart of blueberries?

12. Esther, Susan, and Marietta were talking about their story-books; they found that Esther had 12 books, which was $\frac{3}{4}$ as many as Susan had, and $\frac{2}{3}$ *as many as* Marietta had; how many had Susan? *had Marietta?*

13. Benjamin had some berries in 3 baskets; in

one basket he had $\frac{3}{7}$ of them, in another $\frac{2}{7}$, and in the rest 4 quarts; how many berries had he in all? how many in each basket?

14. A man sold $\frac{1}{4}$ of his land, and then had 9 acres left; how many acres had he before he sold any?

15. After James had given his brother 15 apples, he found that he had only $\frac{1}{3}$ as many left as he had at first; how many had he at first?

16. Peter bought $\frac{3}{5}$ of a pound of raisins at the rate of 12 cents per pound, and he found that it would take just $\frac{4}{5}$ of his money to pay for them; how much money had he? What part of a pound of figs, worth 15 cents per pound, could he buy with the money he would have left after paying for the raisins?

17. Lucia bought $\frac{2}{5}$ of a yard of French calico, for $\frac{6}{11}$ of a dollar; how much would a yard have cost at the same rate? If a yard of this calico is worth as much as $\frac{2}{3}$ of a yard of silk, what will a yard of silk cost?

18. If $\frac{2}{3}$ of a pound of black tea, or $\frac{3}{5}$ of a pound of green tea, cost $\frac{6}{13}$ of a dollar, what will a pound of black tea cost? What will a pound of green tea cost? What will a pound of black tea and a pound of green tea together cost?

19. A man spent $\frac{3}{5}$ of his money for books, $\frac{1}{3}$ of it for paper, $\frac{1}{8}$ of it for pens, and then had $\frac{1}{4}$ of a dollar left; how much money had he at first? How much did he spend for books? how much for paper? for pens?

20. Bought $\frac{3}{4}$ of a pound of raisins, at $13\frac{1}{2}$ cents per pound, and gave in payment $\frac{2}{3}$ of a yard of cloth; what was the cloth worth per yard?

SECTION XXI.

A. 1. What part of 1 is $\frac{1}{2}$ of $\frac{1}{2}$?

Ans. $\frac{1}{2}$ of $\frac{1}{2}$ is $\frac{1}{4}$ of 1; because, if each half be divided into 2 equal parts, the whole will be divided into 2 times 2, or 4 equal parts, and 1 of the parts must be $\frac{1}{4}$ of the whole.

2. What part of 1 is $\frac{1}{3}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{3}$? $\frac{1}{3}$ of $\frac{1}{3}$?
3. $\frac{1}{4}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{4}$? $\frac{1}{5}$ of $\frac{1}{2}$? $\frac{1}{3}$ of $\frac{1}{4}$?
4. $\frac{1}{4}$ of $\frac{1}{3}$? $\frac{1}{2}$ of $\frac{1}{2}$ of $\frac{1}{3}$? $\frac{1}{2}$ of $\frac{1}{6}$? $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{2}$?
5. $\frac{1}{5}$ of $\frac{1}{2}$? $\frac{1}{3}$ of $\frac{1}{2}$ of $\frac{1}{4}$? $\frac{1}{3}$ of $\frac{1}{2}$ of $\frac{1}{2}$ of $\frac{1}{2}$? $\frac{1}{3}$ of $\frac{1}{6}$?
6. $\frac{1}{3}$ of $\frac{1}{3}$ of $\frac{1}{2}$? $\frac{1}{10}$ of $\frac{1}{2}$? $\frac{1}{4}$ of $\frac{1}{5}$?

B. 1. What part of 1 is $\frac{2}{3}$ of $\frac{1}{3}$?

Solution. $\frac{1}{3}$ of $\frac{1}{3}$ is $\frac{1}{9}$ of 1, and $\frac{2}{3}$ of $\frac{1}{3}$ must be 2 times $\frac{1}{9}$ of 1, which are $\frac{2}{9}$ of 1.

2. What part of 1 is $\frac{3}{4}$ of $\frac{1}{2}$? $\frac{5}{6}$ of $\frac{1}{2}$? $\frac{2}{3}$ of $\frac{1}{5}$?
3. $\frac{1}{2}$ of $\frac{3}{4}$? $\frac{1}{5}$ of $\frac{3}{4}$? $\frac{1}{6}$ of $\frac{3}{5}$? $\frac{1}{2}$ of $\frac{7}{9}$? $\frac{1}{3}$ of $\frac{5}{6}$?
4. $\frac{1}{5}$ of $\frac{1}{2}$? $\frac{2}{5}$ of $\frac{1}{4}$? $\frac{3}{4}$ of $\frac{1}{3}$? $\frac{1}{2}$ of $\frac{3}{5}$? $\frac{2}{5}$ of $\frac{1}{4}$?
5. $\frac{1}{5}$ of $\frac{3}{2}$?

C. 1. What part of 1 is $\frac{2}{3}$ of $\frac{3}{5}$?

Solution. $\frac{1}{3}$ of $\frac{3}{5}$ is $\frac{3}{5}$, and $\frac{2}{3}$ of $\frac{3}{5}$ must be equal to 2 times $\frac{3}{5}$, or $\frac{6}{5}$.

2. What part of 1 is $\frac{4}{5}$ of $\frac{3}{5}$? $\frac{3}{4}$ of $\frac{3}{4}$? $\frac{5}{6}$ of $\frac{3}{5}$?
3. $\frac{3}{5}$ of $\frac{3}{4}$? $\frac{2}{3}$ of $\frac{5}{6}$? $\frac{3}{5}$ of $\frac{4}{5}$? $\frac{3}{5}$ of $\frac{3}{4}$? $\frac{3}{5}$ of $\frac{2}{3}$?
4. $\frac{4}{5}$ of $\frac{3}{4}$? $\frac{3}{4}$ of $\frac{2}{5}$? $\frac{5}{6}$ of $\frac{4}{5}$?

D. 1. What will $\frac{1}{3}$ of a pound of indigo cost at $\frac{1}{2}$ of a dollar a pound?

2. What will $\frac{1}{6}$ of a bushel of pears cost, at $\frac{3}{4}$ of a dollar per bushel?

3. At $\frac{5}{6}$ of a dollar per gallon, what cost $\frac{2}{3}$ of a gallon of oil?

4. The price of 5 pounds of soap is $\frac{1}{3}$ of a dollar; *what is the* price of 1 pound?

5. *If I* have to pay $\frac{1}{5}$ of a dollar for 4 inkstands, *what shall I* have to pay for 3?

6. If $\frac{3}{5}$ of a peck of beans cost $\frac{1}{2}$ of a dollar, what will 1 peck cost?

7. If $\frac{3}{4}$ of a yard of silk cost $\frac{4}{5}$ of a dollar, what will 1 yard cost?

8. If $\frac{3}{5}$ of a barrel of flour cost $5\frac{1}{2}$ dollars, what will 1 barrel cost?

9. Amasa had $\frac{3}{5}$ of a bushel of nuts, but he gave away $\frac{1}{4}$ of them; what part of a bushel did he give away?

10. The cars will go from Boston to Springfield in 4 hours; what part of the distance will they go in 1 hour? What part in $\frac{1}{2}$ of an hour? in $\frac{1}{4}$ of an hour? in $\frac{3}{4}$ of an hour? in $\frac{1}{5}$ of an hour?

11. Simon lives $\frac{3}{4}$ of a mile from the schoolhouse, and Luther lives $\frac{3}{4}$ as far as Simon; what part of a mile does Luther live from the schoolhouse?

12. Elisha had some cranberries in a bag; he sold $\frac{1}{3}$ of them, and then had $\frac{3}{4}$ of a bushel left; how many had he at first? What part of a bushel did he sell?

13. Levi bought $\frac{3}{5}$ of a pound of powder, and Ira bought $\frac{4}{5}$ of a pound; Levi gave $\frac{3}{5}$ of a dollar for what he bought, and Ira gave at the same rate for what he bought; what did Ira's powder cost?

14. Bought 8 yards of cloth, for $10\frac{1}{2}$ dollars; what will 1 yard of cloth cost at the same rate? What will 3 yards cost? 4 yards?

15. Mr. Griggs has $11\frac{1}{3}$ barrels of apples, which is just $\frac{5}{8}$ as many as Mr. Corey has; how many has Mr. Corey?

16. When 1 bushel of apples can be bought for $\frac{3}{5}$ of a bushel of pears, how many bushels of apples can be bought for 1 bushel of pears? for $6\frac{1}{3}$ bushels *of pears? for* $3\frac{1}{2}$ bushels?

17. *A person* who owned $\frac{3}{4}$ of a vessel sold $\frac{1}{3}$ of

his share; what part of the vessel did he sell? What part of the vessel did he then own?

SECTION XXII.

A. 1. $\frac{1}{4}$ = how many twelfths?

Solution. 1 equals $\frac{12}{12}$, and $\frac{1}{4}$ must equal $\frac{1}{4}$ of $\frac{12}{12}$, which is $\frac{3}{12}$; therefore, $\frac{1}{4} = \frac{3}{12}$.

2. $\frac{1}{5}$ = how many tenths?
3. $\frac{1}{3}$ = how many eighteenths?
4. $\frac{1}{8}$ = how many sixteenths?
5. $\frac{1}{4}$ = how many twelfths?
6. $\frac{2}{3}$ = how many eighteenths?
7. $\frac{2}{5}$ = how many twentieths?
8. $\frac{3}{8}$ = how many sixteenths?
9. $\frac{4}{7}$ = how many fourteenths?
10. $\frac{8}{9}$ = how many eighteenths?
11. $\frac{8}{9}$ = how many ninths?
12. $\frac{9}{10}$ = how many twentieths?
13. $\frac{7}{9}$ = how many eighteenths?
14. $\frac{3}{5}$ = how many twentieths?
15. $\frac{3}{5}$ = how many tenths?
16. $\frac{2}{5}$ = how many fifteenths?
17. $\frac{1}{3}$ = how many sevenths? *Ans.*, $\frac{2\frac{1}{3}}{7}$.
18. $\frac{1}{6}$ = how many thirteenths?
19. $\frac{3}{7}$ = how many eighteenths?
20. $\frac{5}{6}$ = how many nineteenths?
21. $\frac{4}{5}$ = how many elevenths?
22. $\frac{2}{3}$ = how many ninths?
23. $\frac{8}{9}$ = how many elevenths?
24. $\frac{7}{9}$ = how many seventeenths?
25. $\frac{4}{7}$ = how many fifteenths?
26. Change $\frac{1}{2}$ and $\frac{1}{3}$ to eighteenths.

Ans., $\frac{1}{2} = \frac{9}{18}$, and $\frac{1}{3} =$

27. Change $\frac{1}{3}$ and $\frac{1}{2}$ to sixths.
28. Change $\frac{1}{2}$ and $\frac{1}{3}$ to twelfths.
29. Change $\frac{1}{2}$ and $\frac{1}{3}$ to thirds.

Ans., $\frac{1}{2} = \frac{1\frac{1}{2}}{3}$, and $\frac{1}{3} = \frac{1}{3}$.

30. Change $\frac{1}{2}$ and $\frac{1}{7}$ to sevenths.
31. Change $\frac{1}{4}$ and $\frac{2}{5}$ to twentieths.
32. Change $\frac{1}{4}$ and $\frac{2}{5}$ to thirteenths.
33. Change $\frac{3}{4}$ and $\frac{1}{2}$ to eighths.
34. Change $\frac{3}{4}$ and $\frac{1}{2}$ to fourths.
35. Change $\frac{3}{4}$ and $\frac{1}{2}$ to elevenths.
36. Change $\frac{2}{3}$ and $\frac{1}{5}$ to fifteenths.
37. Change $\frac{2}{3}$ and $\frac{1}{5}$ to tenths.

B. 1. Reduce $\frac{1}{4}$ and $\frac{1}{6}$ to a common denomina tor; that is, change them to equivalent fractions, having their denominators alike.

Solution. The least common multiple of 4 and 6, the given denominators, is 12; we will, therefore, reduce the fractions to twelfths; $\frac{1}{4}$ equals $\frac{3}{12}$, and $\frac{1}{6}$ equals $\frac{2}{12}$.

2. Reduce $\frac{1}{3}$ and $\frac{1}{12}$ to a common denominator.
3. Reduce $\frac{1}{9}$ and $\frac{1}{6}$ to a common denominator.
4. Reduce $\frac{1}{8}$ and $\frac{1}{4}$ to a common denominator.
5. Reduce $\frac{3}{8}$ and $\frac{1}{4}$ to a common denominator.
6. Reduce $\frac{3}{8}$ and $\frac{3}{4}$ to a common denominator.
7. Reduce $\frac{2}{9}$ and $\frac{7}{18}$ to a common denominator.
8. Reduce $\frac{5}{7}$ and $\frac{9}{14}$ to a common denominator.
9. Reduce $\frac{11}{15}$ and $\frac{2}{5}$ to a common denominator.
10. Reduce $\frac{5}{6}$ and $\frac{4}{9}$ to a common denominator.
11. Reduce $\frac{3}{4}$ and $\frac{1}{8}$ to a common denominator.
12. Reduce $\frac{2}{3}$ and $\frac{2}{9}$ to a common denominator.
13. Reduce $\frac{5}{8}$ and $\frac{3}{16}$ to a common denominator.
14. Reduce $\frac{1}{4}$ and $\frac{5}{6}$ to a common denominator.
15. Reduce $\frac{2}{9}$ and $\frac{5}{6}$ to a common denominator.
16. Reduce $\frac{3}{7}$ and $\frac{1}{2}$ to a common denominator

17. Reduce $\frac{1}{3}$, $\frac{3}{4}$ and $\frac{5}{6}$ to a common denominator.

18. Reduce $\frac{3}{8}$, $\frac{5}{16}$ and $\frac{1}{2}$ to a common denominator.

19. Reduce $\frac{2}{6}$, $\frac{1}{3}$ and $\frac{5}{15}$ to a common denominator.

20. Reduce $\frac{1}{4}$, $\frac{3}{10}$ and $\frac{2}{5}$ to a common denominator.

21. Reduce $\frac{5}{6}$, $\frac{1}{9}$, $\frac{1}{18}$ and $\frac{3}{9}$ to a common denominator.

22. Reduce $\frac{2}{3}$, $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{5}{6}$ to a common denominator.

23. Reduce $\frac{3}{7}$, $\frac{3}{14}$ and $\frac{1}{2}$ to a common denominator.

24. Reduce $\frac{2}{6}$, $\frac{1}{6}$, $\frac{1}{2}$ and $\frac{5}{18}$ to a common denominator.

25. Reduce $\frac{3}{10}$, $\frac{7}{20}$, $\frac{1}{4}$ and $\frac{2}{5}$ to a common denominator.

C. 1. How many are $\frac{1}{2}$ and $\frac{1}{3}$?

Direction. First reduce them to a common denominator.

Solution. $\frac{1}{2}$ equals $\frac{3}{6}$, $\frac{1}{3}$ equals $\frac{2}{6}$; $\frac{3}{6}$ and $\frac{2}{6}$ are $\frac{5}{6}$; therefore, $\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$.

How many are $\frac{1}{5} + \frac{1}{2}$? $\frac{1}{4} + \frac{1}{5}$? $\frac{2}{3} + \frac{1}{4}$? $\frac{3}{7} + \frac{1}{2}$? $\frac{1}{3} + \frac{1}{4}$? $\frac{1}{4} + \frac{1}{6}$? $\frac{3}{7} + \frac{5}{14}$? $\frac{3}{9} + \frac{2}{3}$? $\frac{5}{6} + \frac{3}{4}$? $\frac{5}{6} + \frac{4}{9}$?

2. Find the sum of the fractions given in each of the first sixteen examples, under letter B of this section.

Direction. When more than two fractions are to be added, first add the two that can be most easily reduced to a common denominator, and to their sum add each of the remaining fractions; thus, to find the sum of $\frac{2}{3} + \frac{3}{4} + \frac{5}{6} + \frac{7}{12}$, we can first find the *sum of* $\frac{2}{3} + \frac{7}{12}$, which is equal to $1\frac{3}{12}$, or $1\frac{1}{4}$, and *to that add* $\frac{3}{4}$, which gives 2, and to 2 add $\frac{5}{6}$, which *gives for the* sum of the whole $2\frac{5}{6}$.

3. What is the sum of $\frac{2}{5} + \frac{7}{20} + \frac{1}{4}$? $\frac{3}{8} + \frac{3}{4} + \frac{7}{16}$? $\frac{5}{12} + \frac{5}{6} + \frac{3}{4} + \frac{2}{3}$? $\frac{3}{8} + \frac{5}{8} + \frac{5}{16} + \frac{5}{8}$? $\frac{5}{8} + \frac{9}{16} + \frac{1}{2} + \frac{3}{4}$? $\frac{7}{10} + \frac{4}{5} + \frac{3}{4} + \frac{7}{20}$?

4. Find, in the same manner, the sum of the fractions given in each of the last nine examples under letter B of this section.

5. How many are $2\frac{1}{2} + 5\frac{3}{4}$? $7\frac{3}{8} + 2\frac{5}{6}$? $3\frac{2}{9} + 2\frac{5}{6} + 1\frac{2}{3}$? $8\frac{3}{4} + 5\frac{1}{2} + 2\frac{5}{8}$? $6\frac{3}{7} + 2\frac{1}{2} + \frac{5}{14}$? $8\frac{3}{5} + 6\frac{7}{10} + 2\frac{3}{10}$? $5\frac{8}{9} + 3\frac{1}{3} + 4$? $7\frac{2}{7} + 3\frac{1}{2} + 2$? $2\frac{1}{6} + 1\frac{3}{4} + 5\frac{2}{3} + 7\frac{1}{2}$? $3\frac{2}{9} + 5\frac{5}{6} + 2\frac{2}{9} + 6\frac{1}{6}$? $3\frac{2}{5} + 4\frac{1}{4} + \frac{3}{10}$? $3\frac{7}{8} + 2\frac{1}{4} + 5\frac{3}{16} + 7\frac{1}{2}$? $8\frac{6}{10} + 2\frac{1}{5} + 5\frac{1}{4} + 2\frac{5}{10} + \frac{1}{20}$? $8\frac{9}{10} + 2\frac{2}{5} + 1\frac{5}{8}$? $3\frac{2}{3} + 2\frac{2}{9} + 2\frac{5}{6} + 4\frac{1}{2}$? $4\frac{1}{2} + 1\frac{3}{4} + 3\frac{5}{6} + 5\frac{2}{3} + 2\frac{7}{12}$?

6. How many are $\frac{2}{3} - \frac{1}{2}$? $\frac{1}{2} - \frac{1}{3}$? $\frac{1}{3} - \frac{1}{4}$? $\frac{1}{4} - \frac{1}{5}$? $\frac{1}{4} - \frac{1}{6}$? $\frac{1}{2} - \frac{1}{7}$? $\frac{3}{5} - \frac{3}{5}$? $\frac{5}{8} - \frac{1}{8}$? $\frac{6}{7} - \frac{3}{14}$? $\frac{7}{12} - \frac{1}{4}$?

7. Find the difference between the fractions given in each of the first sixteen examples under letter B of this section.

8. How many are $2\frac{5}{6} - 1\frac{1}{3}$? $8\frac{7}{12} - 3\frac{1}{4}$? $5\frac{3}{5} - 1\frac{1}{6}$? $3\frac{1}{5} - 2\frac{1}{10}$? $5\frac{3}{8} - 2\frac{1}{6}$? $7\frac{1}{2} - 3\frac{3}{4}$? $16\frac{2}{5} - 5\frac{7}{10}$? $8\frac{3}{14} - 2\frac{5}{7}$? $14\frac{1}{7} - 6\frac{1}{3}$? $9\frac{3}{4} - 5\frac{3}{8}$? $2\frac{3}{5} - 5\frac{1}{6}$? $7\frac{5}{8} - 2\frac{1}{16}$? $12\frac{7}{15} - 4\frac{3}{5}$? $4\frac{1}{2} - 1\frac{3}{4}$? $4\frac{5}{8} - 2\frac{3}{4}$? $6\frac{3}{5} - 4\frac{5}{8}$? $5\frac{1}{2} - 3\frac{7}{12}$? $19\frac{5}{8} - 11\frac{9}{16}$? $17\frac{5}{9} - 12\frac{2}{3}$? $15\frac{3}{4} - 6\frac{4}{5}$? $20\frac{1}{4} - 17\frac{9}{10}$? $13\frac{1}{3} - 12\frac{1}{2}$?

D. 1. Rufus bought a slate for $\frac{1}{4}$ of a dollar, a writing-book for $\frac{1}{8}$ of a dollar, a geography for $\frac{1}{2}$ of a dollar, an atlas for $\frac{3}{8}$ of a dollar, and a spelling-book for $\frac{5}{16}$ of a dollar; how much did the whole cost? He gave in payment $1\frac{3}{4}$ dollars; how much money ought he to receive in return?

2. Mr. Clough had a small garden, which it took him $2\frac{2}{5}$ hours to plough, and $6\frac{1}{3}$ hours to plant; how many hours did it take him to plough and plant it? *How many* more hours to plant than to plough it?

3. *Sophia* spends $2\frac{1}{2}$ hours each day in studyin

history, $1\frac{3}{4}$ hours in studying geography, $1\frac{3}{8}$ hours in studying grammar, and $1\frac{5}{8}$ hours in studying arithmetic; how many hours does she spend in the study of all these branches?

4. John had $4\frac{3}{4}$ dollars; he spent $1\frac{3}{4}$ dollars for books, and $\frac{5}{8}$ of a dollar for drawing materials, and then gave what money he had left to his father; how many dollars did he give to his father? How many more did he spend than he gave to his father? How many more dollars did he give to his father than he spent for books? than for drawing materials? How many more dollars did he spend for books than for drawing materials?

5. A stable-keeper bought 3 loads of hay; the first load, with the wagon on which it was loaded, weighed $1\frac{5}{8}$ tons, the second weighed $2\frac{1}{4}$ tons, and the third weighed 2 tons; what was the weight of the whole, including the wagons? After unloading the hay, the wagons were weighed. The first wagon weighed $\frac{1}{2}$ of a ton, the second weighed $\frac{5}{8}$ of a ton, and the third weighed $\frac{3}{8}$ of a ton; how much did all the wagons weigh? How much did all the hay weigh? How much did the hay on the first wagon weigh? did the hay on the second? on the third?

6. Miss Wilbur bought a work-box for $1\frac{1}{2}$ dollars, a pair of scissors for $\frac{5}{8}$ of a dollar, a paper of needles for $\frac{1}{4}$ of a dollar, a needle-book for $\frac{3}{16}$ of a dollar, and a thimble for $\frac{9}{16}$ of a dollar; what did the whole cost? She gave the shop-keeper $3\frac{1}{2}$ dollars; how much change ought she to receive back?

7. Mr. Goodwin picked $1\frac{1}{8}$ bushels of cranberries on Monday, $2\frac{3}{4}$ bushels on Tuesday, $1\frac{1}{2}$ bushels on *Wednesday*, $2\frac{7}{12}$ bushels on Thursday, $1\frac{3}{8}$ bushels *on Friday, and* $4\frac{1}{16}$ bushels on Saturday; how many *bushels did he pick* during the week?

8. Samuel was 5 hours in going from home to his aunt's, the distance being 20 miles. The first hour he traveled $3\frac{3}{4}$ miles, the second $3\frac{3}{5}$, the third $4\frac{1}{12}$, and the fourth $3\frac{1}{2}$; how far did he travel in the first four hours? How far in the fifth hour? How much further in the first four hours than in the fifth hour?

9. A trader sold some brown sugar for $3\frac{1}{3}$ dollars, some white sugar for $4\frac{3}{4}$ dollars, some tea for $2\frac{5}{6}$ dollars, some coffee for $2\frac{1}{2}$ dollars, some chocolate for $1\frac{1}{4}$ dollars, and some rice for $4\frac{7}{12}$ dollars; for how much did he sell the whole? For how much did he sell the sugar and tea? For how much did he sell the coffee, chocolate, and rice? How much more did he get for the chocolate and rice than for the coffee and tea? How much more did he get for the sugar and rice than for all the other articles?

10. Mr. Briggs bought 3 books at $4\frac{2}{5}$ shillings apiece, and 2 books at $1\frac{3}{4}$ shillings apiece; how much did they all cost? How much more did the first lot of books cost than the second?

11. Mr. Flint sold $3\frac{1}{2}$ barrels of oil to Mr. Chase, $2\frac{2}{3}$ barrels to Mr. White, $5\frac{1}{5}$ barrels to Mr. Fisher, and then had $4\frac{1}{4}$ barrels left; how many barrels did he have before he sold any? How many more did he sell to Mr. Chase and Mr. White than to Mr. Fisher? How many more barrels than he now has, must he get to have as many as he sold?

12. Mr. Atwood had $9\frac{3}{4}$ bushels of cranberries, and he gave $6\frac{1}{3}$ bushels of them for $4\frac{1}{2}$ barrels of apples, worth 2 dollars per barrel; how many bushels of cranberries had he left? How many dollars' worth of apples did he get for the cranberries he sold?

13. Mr. Kent sold 8 bushels of nuts, at $2\frac{1}{4}$ dollars *per bushel*; how much did he get for them?

Of the money he thus received, he spent enough to buy 7 pounds of cocoa at $\frac{1}{4}$ of a dollar per pound, 2 water-pails at $\frac{1}{2}$ of a dollar apiece, and 9 brooms at $\frac{2}{5}$ of a dollar apiece; how much did he spend? How much did he have left?

14. A farmer has $\frac{2}{3}$ of his sheep in one pasture, $\frac{1}{2}$ of them in another, and the rest, 2 sheep, in another; how many sheep has he in all? How many in each pasture?

15. Amy's father gave her some oranges; she gave $\frac{1}{3}$ of them to her sister, $\frac{1}{4}$ of them to her brother, and had 1 orange left; how many did she have at first? How many did she give to her sister? How many to her brother?

16. Mr. Bryant has lent $\frac{1}{4}$ of his money to Mr. Benson, $\frac{1}{5}$ of it to Mr. Conant, $\frac{3}{20}$ of it to Mr. Underwood, and the rest, 8 thousand dollars, to Mr. Gilmore; how many thousand dollars does he own? How many thousand dollars has he lent to Mr. Benson? to Mr. Conant? to Mr. Underwood?

17. Benjamin, on being asked his age, replied, "I have spent $\frac{5}{18}$ of my life in Brookline, $\frac{1}{6}$ of it in Dorchester, $\frac{2}{9}$ of it in Newton, and the rest of it, 4 years, I have spent in Boston; now, if you can tell me my age, I will tell you the age of my brother Herbert, who is $\frac{3}{4}$ as old as I am." What was Benjamin's age? What was Herbert's age?

18. A drover says that if he sells $\frac{1}{2}$ of his sheep to one man, and $\frac{1}{4}$ of them to another, he shall sell 3 more sheep to the first man than to the second; how many sheep has the drover?

19. Albert gave $\frac{1}{5}$ of his money for a ball, and $\frac{1}{2}$ of it for a top, and he found that the top cost 6 cents *more than the ball*; how much money had he? How *much did his ball* cost? did his top? How much *money had he left* after buying the top and ball?

20. James and George were talking about their ages. James said that $\frac{1}{2}$ of his age exceeded $\frac{1}{3}$ of it by 2, to which George replied, "Then you are only $\frac{3}{4}$ as old as I am." What was the age of each of the boys?

21. Mr. Rodman employed a laborer to dig some potatoes; the laborer worked one day, digging $\frac{1}{10}$ of the potatoes before breakfast, $\frac{2}{5}$ of them between breakfast and dinner, and the rest of them after dinner. He dug 8 bushels more of potatoes after dinner than he dug before breakfast; how many bushels did he dig in all?

22. There is an orchard in which $\frac{2}{5}$ of the trees bear peaches, $\frac{1}{5}$ bear cherries, $\frac{1}{3}$ bear apples, and the rest bear pears. Now, if there are 2 more apple trees than peach trees, how many trees are there in the orchard? How many trees are there of each sort?

23. Mr. Packard sold 4 barrels of apples and 2 barrels of pears for 17 dollars. He received twice as much a barrel for his pears as for his apples; how much did he receive a barrel for each?

24. Sylvester found a certain number of apples under one tree, and $\frac{1}{2}$ as many more under another. He ate 2 of them, and then had 16 left; how many did he find under each tree?

25. Angeline, Margaret and Frances went a blackberrying together. Angeline picked enough to fill her basket $1\frac{1}{2}$ times, Margaret picked twice as many as Angeline, and Frances picked $\frac{1}{3}$ as many as Margaret. They all picked 11 quarts; how many quarts did Angeline's basket hold? How many quarts did each of the girls pick?

26. Mr. Steele, Mr. Bodwell, and Mr. Bloom, each wished to hire Mr. Morgan for a week. Mr. Steele offered him a certain sum, $\frac{1}{4}$ of which he said

he would pay in cloth, $\frac{1}{12}$ in leather, $\frac{1}{8}$ in groceries, and the rest, 3 dollars, in money; Mr. Bodwell offered him a sum for the week, $\frac{1}{4}$ of which he said he would pay in cloth, $\frac{3}{20}$ in money, and the rest, 7 dollars, in books; Mr. Bloom offered to pay $\frac{1}{8}$ of his week's wages in bricks, $\frac{1}{2}$ in carpenter's tools, $\frac{1}{4}$ in money, and the remainder, $1\frac{2}{3}$ dollars, in shingles. He worked for the one who offered him the most; for which did he work? How many dollars did Mr. Steele offer to pay him in cloth? How many in leather? in groceries? How many dollars did Mr. Bodwell offer to pay him in cloth? How many in money? How many dollars did Mr. Bloom offer to pay him in bricks? How many in carpenter's tools? How many in money?

27. There are $\frac{2}{3}$ as many acres in Mr. Jones' orchard as there are in his pasture, and in his garden there are $\frac{1}{2}$ as many as in his pasture. In his pasture, orchard and garden together, there are 13 acres; how many acres are there in his orchard? in his pasture? in his garden?

TABLES OF MONEY, WEIGHTS, AND MEASURES, IN COMMON USE.

UNITED STATES MONEY.

10 mills = 1 cent.
10 cents = 1 dime.
10 dimes = 1 dollar.
10 dollars = 1 eagle.

ENGLISH MONEY.

4 farthings = 1 penny.
12 pence = 1 shilling.
20 shillings = 1 pound.
21 shillings = 1 guinea.
5 shillings = 1 crown.

TROY WEIGHT.

24 grains = 1 pennyweight.
20 pennyweights = 1 ounce.
12 ounces = 1 pound.

APOTHECARIES' WEIGHT.

20 grains = 1 scruple.
3 scruples = 1 dram.
8 drams = 1 ounce.
12 ounces = 1 pound.

AVOIRDUPOIS WEIGHT.

16 drams = 1 ounce.
16 ounces = 1 pound.
28 pounds = 1 quarter.
4 quarters = 1 hundred weight.
20 hundred weight = 1 ton.

In several of the States the hundred weight has been fixed by law at 100 and the quarter at 25 pounds; but in the standard of the General Government they are reckoned as above.

DRY MEASURE.

2 pints = 1 quart.
8 quarts = 1 peck.
4 pecks = 1 bushel.

LIQUID MEASURE

4 gills	= 1 pint.
2 pints	= 1 quart.
4 quarts	= 1 gallon.

LONG MEASURE.

12 inches	= 1 foot.
3 feet	= 1 yard.
5½ yards, or 16½ feet	= 1 rod.
40 rods	= 1 furlong.
8 furlongs	= 1 mile.
3 miles	= 1 league.

CLOTH MEASURE.

2¼ inches	= 1 nail.
4 nails	= 1 quarter.
4 quarters	= 1 yard.

SQUARE MEASURE.

144 square inches	= 1 square foot.
9 square feet	= 1 square yard.
30¼ square yards, or 272¼ square feet	= 1 square rod.
40 square rods	= 1 square rood.
4 square roods	= 1 square acre.
640 square acres	= 1 square mile.

CUBIC MEASURE.

1728 cubic inches	= 1 cubic foot.
27 cubic feet	= 1 cubic yard.
16 cubic feet	= 1 cord foot.
8 cord feet	= 1 cord.

TIME.

60 seconds	= 1 minute
60 minutes	= 1 hour.
24 hours	= 1 day.
7 days	= 1 week.
52 weeks 1¼ days, or 365¼ days	= 1 year.
100 years	= 1 century.

There are 12 months in the year, viz: —

January,	which	has	31 days.
February,	"	"	28 days.*
March,	"	"	31 days.
April,	"	"	30 days.
May,	"	"	31 days.
June,	"	"	30 days.
July,	"	"	31 days
August,	"	"	31 days.
September,	"	"	30 days.
October,	"	"	31 days.
November,	"	"	30 days.
December,	"	"	31 days.

"Thirty days hath September,
April, June, and November;
All the rest have thirty-one,
Except the second month alone,
To which we twenty-eight assign,
Till Leap Year gives it twenty-nine."

TABLE OF PARTICULARS.

20 things = 1 score.
12 things = 1 dozen.
12 dozen = 1 gross.
12 gross = 1 great gross.

PAPER.

24 sheets = 1 quire.
20 quires = 1 ream.

* Every fourth year is called Leap Year; and in that, February has 29 days.

MULTIPLICATION TABLES.

2.	3.	4.
2 × 1 = 2.	3 × 1 = 3.	4 × 1 = 4.
2 × 2 = 4.	3 × 2 = 6.	4 × 2 = 8.
2 × 3 = 6.	3 × 3 = 9.	4 × 3 = 12.
2 × 4 = 8.	3 × 4 = 12.	4 × 4 = 16.
2 × 5 = 10.	3 × 5 = 15.	4 × 5 = 20.
2 × 6 = 12.	3 × 6 = 18.	4 × 6 = 24.
2 × 7 = 14.	3 × 7 = 21.	4 × 7 = 28.
2 × 8 = 16.	3 × 8 = 24.	4 × 8 = 32.
2 × 9 = 18.	3 × 9 = 27.	4 × 9 = 36.
2 × 10 = 20.	3 × 10 = 30.	4 × 10 = 40.

5.	6.	7.
5 × 1 = 5.	6 × 1 = 6.	7 × 1 = 7.
5 × 2 = 10.	6 × 2 = 12.	7 × 2 = 14.
5 × 3 = 15.	6 × 3 = 18.	7 × 3 = 21.
5 × 4 = 20.	6 × 4 = 24.	7 × 4 = 28.
5 × 5 = 25.	6 × 5 = 30.	7 × 5 = 35.
5 × 6 = 30.	6 × 6 = 36.	7 × 6 = 42.
5 × 7 = 35.	6 × 7 = 42.	7 × 7 = 49.
5 × 8 = 40.	6 × 8 = 48.	7 × 8 = 56.
5 × 9 = 45.	6 × 9 = 54.	7 × 9 = 63.
5 × 10 = 50.	6 × 10 = 60.	7 × 10 = 70.

8.	9.	10.
8 × 1 = 8.	9 × 1 = 9.	10 × 1 = 10.
8 × 2 = 16.	9 × 2 = 18.	10 × 2 = 20.
8 × 3 = 24.	9 × 3 = 27.	10 × 3 = 30.
8 × 4 = 32.	9 × 4 = 36.	10 × 4 = 40.
8 × 5 = 40.	9 × 5 = 45.	10 × 5 = 50.
8 × 6 = 48.	9 × 6 = 54.	10 × 6 = 60.
8 × 7 = 56.	9 × 7 = 63.	10 × 7 = 70.
8 × 8 = 64.	9 × 8 = 72.	10 × 8 = 80.
8 × 9 = 72.	9 × 9 = 81.	10 × 9 = 90.
8 × 10 = 80.	9 × 10 = 90.	10 × 10 = 100

THE PESTALOZZIAN SERIES OF SCHOOL ARITHMETICS.

Part One.

THE FIRST STEPS IN NUMBERS. By D. P. Colburn and G. A. Walton.

Part Two.

THE DECIMAL SYSTEM OF NUMBERS ILLUSTRATED AND PRACTICALLY APPLIED. By Dana P. Colburn.

Part Three

Is in preparation, and will soon be published.

RECOMMENDATIONS.

A lady, writing from Wells River, Vermont, under date of July 1st, 1852, says, of the First Steps:

I cannot tell you how delighted I am with that book. It has thrown a new charm around the subject of arithmetic. Two scholars that I gave up last winter as almost hopeless are no longer dull in figures, but look forward as eagerly to the hour of recitation as to the hour of play.

From J. W. Upton, Esq., now Teacher of English Department of Pinkerton Academy, Derry, N. H.

Greenfield, February 26th, 1850.

Gentlemen:

During the present term of my school, my assistant has used the copy of your Arithmetic which you had the kindness to present me. I find that the scholars (though not provided with books) have attained a greater facility in the performance of examples in the different text-books used by them in their several classes; that no other arithmetic takes so well with them; that more interest is manifested in recitation; and that the mental discipline is not only good, but practical.

Satisfied that much has been done with one book, and that if our scholars can each have a book of the same kind more will be done, I shall earnestly endeavor to have our committee *adopt* your arithmetic as a text-book.

Yours, respectfully,
JOSEPH W. UPTON.

From N. Tillinghast, Esq., Principal of Bridgewater Normal School.

Bridgewater, May 11th, 1852.

D. P. Colburn, Esq.:

Dear Sir: I have used your "Decimal Arithmetic" with a class of my pupils from the commencement of the Written Arithmetic to the end of the volume; and, therefore, feel able to speak of it with some degree of confidence.

It seems to me by far the best introduction to the science of arithmetic that I have seen. It has done more for my pupils than any book I have ever used; I have found but very little necessity for verbal explanations. I cannot well see how a scholar could go faithfully over it, without acquiring a good knowledge of the principles and practice of arithmetic.

N. TILLINGHAST.

Winchester, May 7th, 1852.

Gentlemen:

I have examined the First Steps in Numbers with some degree of care, and, after trying experiments with various pupils, find it superior to any primary arithmetic with which I am acquainted. It interests the scholar, gives good practical ideas of numbers, serves as a mental discipline, and is just the book to be used in the primary school, to prepare pupils for the grammar school.

WILLIAM MOULTON,
Principal of Gifford School.

The following is from Messrs. Baxter and Atwood, of Charlestown.

Messrs. Colburn and Walton:

We have examined your "First Steps in Numbers," and are highly pleased with the work. It is admirably adapted to occupy a place among our school-books that no other treatise with which we are acquainted has yet *filled.*

Its systematic arrangement, simple and varied combinations of numbers, and apt illustrations, are just what is needed to lead the child through his *first steps* in *numbers* in a manner interesting, yet thorough, giving him so clear an idea of the value and use of numbers, that in his *future steps* he will meet with but few of the difficulties which now beset the path of the student in arithmetic.

(Signed)

STACY BAXTER,
Principal of Harvard School, No. 1.
DAVID ATWOOD,
Principal of Bunker Hill School.

From Thomas Sherwin, Esq., Principal of English High School, Boston.

Gentlemen:

I have perused, with much pleasure, your "First Steps in Numbers," and am happy to give it my hearty commendation. The work contains several important principles not commonly introduced into primary arithmetic, and the exercises are well adapted to give the learner a thorough knowledge of these principles, and great facility in the application of them. I hope your treatise will be introduced into general use.

Very respectfully yours,

THOMAS SHERWIN.

From Samuel S. Green, Esq., Boston.

Messrs. Colburn & Walton:

I have examined your "First Steps in Numbers." It is an excellent work, and is well adapted to beginners. Its merits consist in the thoroughness of the drill to which it subjects the pupil, in the clear and gradual development of the elementary processes of numerical calculation, and in admirably preparing the way for written arithmetic.

SAMUEL S. GREEN,
Principal of the Phillips Grammar School, Boston.

From John A. Goodwin, Westerly, R. I., Principal of the High School, and Special Committee for the examination of Teachers.

Gentlemen:

As an admirer of Warren Colburn's "First Lessons," I rejoice to see so many of the improvements and further developments of his system, long demanded by teachers, at length brought out in your little book.

Among the improvements, permit me to mention the ease and regularity of the steps, the want of which gives so much trouble to the student of the "First Lessons;" and, as further developments, to refer to the valuable sections relating to *factors*, *multiples*, and various operations on fractions.

Having used your book in my school for several weeks, in which time I have given oral instruction from all its most important sections, I am prepared to give it my entire approbation.

(Signed) JOHN A. GOODWIN.

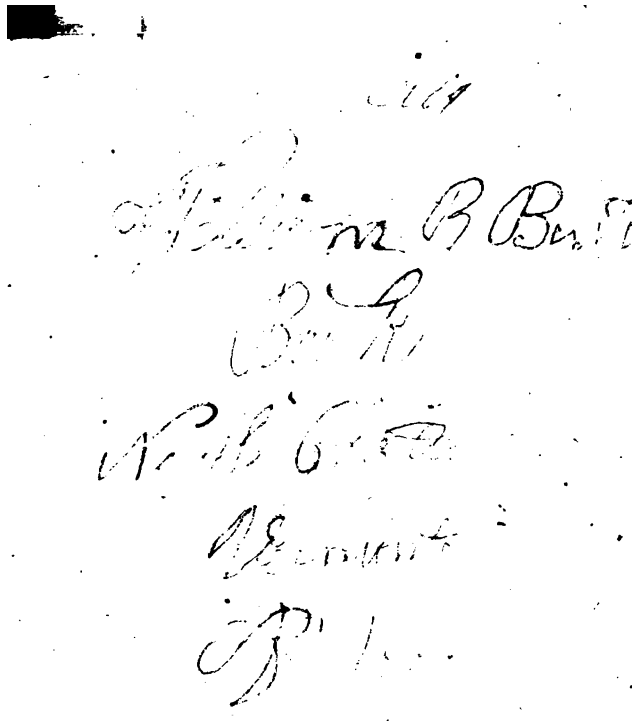
In a note, of August 31st, 1849, George B. Emerson, Esq., says:

I have looked over your work with interest, and cannot but think it very valuable. It takes up numbers in a way different from that of the author of First Lessons, and supplies some deficiencies, especially as introductory to the use of the slate. * * * I believe that the faithful use of the "First Steps" will be an excellent introduction to the knowledge of arithmetic.

D. S. Rowe, Esq., of the Westfield Normal School, writes:

I have examined your book, and have been generally pleased with the matter and manner. I have taken occasion, several times, to commend it to my pupils, as in several important points preferable to other books of the kind before the public. We shall use it in the Model School. I hope you may find a general appreciation of its merits, and, of consequence, see it introduced into our common schools.

It is a difficult thing to make an Arithmetic, out of which, and according to which, children can be taught the nature and use of numbers successfully. The one before us, the work of two experienced teachers, who are evidently masters of their subject, is laid before the public, aiming to be such a treatise; and, from a careful examination of its pages, it appears to possess merits equal to the design of the authors. Being the *first steps* in numbers, it takes the pupil at 1, and leads him on, with a skilful hand, step by step, up the arithmetical stairs, in all conceivable ways, keeping him so long, and drilling him so thoroughly, upon each, that he cannot fail to get a good knowledge of the ground he travels. The book is perfectly systematic throughout. Its arrangement is most careful and correct. Its examples are interestingly and happily written. It seems to be a *complete* elementary arithmetic, admirably calculated to give the pupil a clear understanding of the operations to be performed with numbers, to the extent which it reaches. We take pleasure in calling the attention of teachers to this work, which has already been introduced into several important towns in the state. — *Scholar's Gazette.*



RECOMMENDATIONS.

The following votes passed by the School Committee of Lawrence, and signed by them, have been received:

Voted, That, from a careful examination of "The First Steps in Numbers," by Messrs. Colburn and Walton, we consider the work admirably adapted to the end for which it was prepared. It is so strictly and thoroughly elementary, its arrangement is so systematic, its steps are so gradual, and the pupil is so well drilled upon the various combinations of simple numbers — as we think he must understand what he passes over, — consequently, interested in its study, and well prepared to ascend the higher steps in numbers. Therefore,

Voted, That said work be adopted as a Text-book in the public schools of this town.

(Signed,) GEORGE PARKER,
L. WATTSON,
N. W. HARMON,
HENRY P. HARRINGTON,
JAMES D. HERRICK,
} *School Committee.*

The Rev. T. P. THOMAS, of the School Committee of Bridgewater, under date of Nov. 21th, 1848, writes:

"At a meeting of the School Committee, on Wednesday, I was directed to recommend your new book on Arithmetic for use in our district schools. I am desirous to see it come into very general use, because I think it extremely well adapted to its design. It is well named 'First Steps to Numbers,' and I think if pupils can be taken such steps, their progress, when they are able to go without leading, will be rapid and sure."

From the Boston Advertiser.

"As its name imports, it is designed to be the first steps towards a knowledge of arithmetic, and most perfectly does it effect its design. The hints contained in the 'Introductory Observations' are sufficient to convince one that the authors have no ordinary acquaintance with the subject of numbers. We would recommend this part particularly to the notice of teachers and school committees. Indeed, every part of the work is so well conceived that a perfect analysis of it would require its reproduction. Its arrangement is so systematic, its examples so interesting, and its treatment of the elementary principles and operations so natural, that the pupil must be entranced even happily to a thorough comprehension of this useful branch of school study."